Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Journal of the Society of Arts.

◆

FRIDAY, DECEMBER 25, 1868.

Announcements by the Council.

◆

FINAL EXAMINATIONS, 1869.

NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

In order to avoid holding these Examinations on the same evenings as those of the Department of Science and Art, it has been decided to hold them, in 1869, on the evenings of

TUESDAY, the **20th APRIL,**
WEDNESDAY, the **21st** ,,
THURSDAY, the **22nd** ,,
FRIDAY, the **23rd** ,,

From 7 p.m. to 10 p.m., instead of on the 27th, 28th, 29th, and 30th April, as announced in the Programme of Examinations for 1869.

In consequence of this alteration the Previous Examinations must be held earlier, and the Forms No. 2 and No. 4, referred to in par. 6 of the Programme, must of course be sent in a week earlier than the dates there fixed for receiving them.

It is very important that this alteration should be made as public as possible. For this purpose a number of small slips, to be inserted between pages 8 and 9 of every Programme sent out, will be forwarded to each Institution and Local Board. They should also be specially sent to any person to whom Programmes may have already been forwarded.

Large bills, to be suspended on the walls of the Institution reading-room, or in some other public place, will also be provided.

SUBSCRIPTIONS.

The Michaelmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

◆

CANTOR LECTURES.

The concluding lecture of Mr. W. H. Perkin's course "On the Aniline or Coal Tar Colours," was delivered on Monday evening, the 21st inst. The publication of this course of lectures will commence in next week's *Journal.*

SIXTH ORDINARY MEETING.

Wednesday, December 23rd, 1868; T. N. R. MORSON, Esq., in the chair.

The following candidates were proposed for election as members of the Society:—

Bate, John, 16, Northumberland-street, Strand, W.C.
Falcke, Philip, 23, Bedford-square, W.C.
Learmonth, Dr., Clapham-park, S.W.
Smith, Frederick, 23, York-street, Lambeth, S.E.

The following candidates were balloted for, and duly elected members of the Society:—

Fison, E. Herbert, Stoke-hill, Ipswich.
Marchisio, Dr. J. E., 50, Baker-street, Portman-sq., W.
Stallard, J. H., M.D., 7, King's-rd., Bedford-row, W.C.
Sullivan, Thomas Durell, 56th Regiment.
Taylor, Edward James, Shawfield-street, King's-road, Chelsea, S.W.

The Paper read was—

DESCRIPTION OF THE ELECTRIC ORGAN.

BY HENRY BRYCESON, ESQ.

Having introduced the electric organ into England during the present year, I could scarcely decline to read a paper before this Society, although I am fully sensible of the position I must occupy, as an organ builder, even in attempting to interest a scientific audience, few of whom, perhaps, comprehend the internal structure of the organ, much less the difficulties which have beset the construction of large instruments.

Before, therefore, I can proceed to explain the nature and advantage of the application of electricity to organ building, I must first notice the ordinary construction of an organ—at least such parts as you will see are affected by the innovation, viz., the sound-board and the action, or train of mechanism connecting the finger-key with the same. The sound-board is that portion of an organ through which the compressed air from the bellows is distributed to the various pipes placed over and around it. Diagram 1 represents the end section of an ordinary sound-board. The lower division runs the whole length, and contains compressed air. Above this are placed grooves, corresponding in number with the compass of the key-board. A separate pallet, held up by a spring beneath each groove, prevents the compressed air from entering till depressed with the key. On the top of these grooves is a horizontal partition called the table; and between this and the upper boards, on which the pipes stand, are the sliders, which are allowed to move backward and forward lengthways, being under command of the drawstop knobs at the keys. Ranks of pipes, called stops, are arranged in lines immediately over these sliders. The holes beneath the pipes are pierced through the upper board, sliders, and table, into the grooves below, but when the slider is moved a little to one end, this communication is cut off by it. Each slider, therefore, is made to control a stop of pipes by admitting or stopping the supply of wind passing through the pallet. The key action is the train of mechanism which is employed to pull open the pallets in the sound-board, and for this purpose backfalls, or levers, squares, rollers, trackers, and stickers are chiefly used to connect the key-board with the sound-board. The drawstop action, which attaches the slider to the knob, usually comprehends levers, trundles or rollers, squares, and connecting-rods, all of a much stouter and stronger description than those employed for key action.

In large organs where many ranks of pipes are placed on each sound-board, the pallets have to be made of considerable size to supply sufficient wind to the pipes when used collectively; and as the pallet in a state of rest has the force of the compressed air acting against the underside, it offers a resistance to the finger of the performer often equal to several pounds weight; this is again increased by the necessity of coupling two or more manuals with their additional springs, till at last playing becomes a matter of physical impossibility. Leverage cannot be gained in the action, neither would it do to increase the depth of the touch at the key to effect this. This great difficulty has always engaged the minds of the ingenious, and many have been the trials of pallets so constructed that the pressure of the wind would either be counterbalanced, or reduced considerably, by allowing a small portion to enter the groove first, and thus assist the opening of the pallet. Diagram 2 represents the construction of a few of these pallets. The first, known as Barker's, consists of two parts, the one fixed on the back of the other; the main large pallet has a small opening through it, overlaid by the second valve beneath, the link or connecting wire is attached to this and opens it a little way so as to allow the pressure to get on the other side, and, finally, the main pallet is drawn down with it. The second figure is Mr. Holt's pallet. This acts in a similar way, the short piece in front being opened first. The third figure is a pallet patented by Mr. Willis in 1861. The outside resembles an ordinary pallet, but is hollowed out on the top side, leaving only the portion of its surface that laps its seat; the top is covered all over with the usual soft leathern packing. Holes communicate through the outside into its interior, several bars forming a grating are placed inside the groove between the sound-board bars to prevent the leathern packing being blown in by the pressure of air on the underside; on opening this pallet the edges leave their seat first and offer little resistance, the air having passed in in sufficient quantity relieves the pressure on the underside. The fourth figure is a compensating pallet. The small bellows attached to the tail have a communication from their interior with the atmosphere, the compressed air in the sound-board has therefore an inclination to collapse them, and the force expended in this direction counterbalances the pressure against the pallet. Another description of light pallet, patented by us at the commencement of the present year, will be explained in a later part of the paper. There are many other forms and modifications of light pallets which it is unnecessary for me to mention or describe here.

Light pallets have been and still are extensively employed in organ building, but in very large organs they do not fulfil all, or nearly all that is requisite; indeed, they become treacherous when impeded with action work, and until Mr. Barker invented the "pneumatic lever," it was impossible to give full effect in the shape of combination, or avoid defective execution in rapid passages in an organ of magnitude. This application has elsewhere been aptly described: "The pneumatic machine is an intermediatory apparatus, introduced between the finger-board and the pallets, or valves, of the organ, and is composed of as many little bellows as there are keys on the principal finger-board. Each key, instead of acting on the sound-board pallet, acts only on a small and very light valve, which admits compressed air into the corresponding power-bellows; the latter, supposed to be previously in a collapsed state, yields to the pressure of the wind, and in expanding, opens with great rapidity the sound-board pallets with which it is connected. These remain open as long as the finger of the performer retains the depressed key; but no sooner is this latter released, than the valve which admitted the air into the power-bellows closes, and, another valve opening to allow this air to escape, the bellows falls, and the sound-board pallets close immediately by the action of their springs. Now, as by an appropriate disposition of levers the pallets corresponding with each of the sets of keys in a large organ can be brought under the action of the pneumatic machine, it is evident all the ordinary effects of couplers can be produced without increasing in the slightest degree the weight of the touch, and it then becomes easy to introduce other couplers, which give, in addition to the unisons, the octave above and below the note struck. In this way a single stop produces the effect of three stops respectively of 4, 8, and 16 feet." The pneumatic lever, therefore, occupies a most important position. The top figure of Diagram 3 represents the section of a single application on a greatly enlarged scale, in order to show the action of the throttle valve (patented by Mr. Willis in 1853) and the double exhaust valves, and auxiliary spring which closes them with the first motion of the key, instead of being pressed home only by the last, thus ensuring rapidity of action as well as certainty. Many modifications of the original form have been used, but the following explanation will suffice.

The lowest chamber on the right contains highly-compressed air, derived from a reservoir; the lever, carrying the valve which cuts off the communication between this chamber and the one immediately above it, works through an air-tight leathern purse in the centre, and the left-hand end of the lever moves the double exhaust-valves, and is attached at the extremity by a tracker or connecting rod to the tail of the key. On raising this end of the lever the double exhaust-valves are immediately closed, cutting off or preventing the atmosphere from entering the interior of the power-bellows; at the same time the valve at the other end is opened, so as to allow the compressed air to pass through the chamber above into the power-bellows, and so inflate them. As they rise they draw up the throttle-valve, which is attached to the top board, so that on its reaching the seat provided for it, it cuts off further supply of compressed air, and checks the motion of the power-bellows almost noiselessly. This movement of the top-board is communicated to the sound-board pallets by the usual train of mechanism. Immediately the key is released by the finger it is returned to its former position by the spring underneath, the compressed air escapes by the exhaust-valve, and the power-bellows collapse and allow the sound-board pallet to close. These pneumatic power-bellows are usually arranged in a frame of seven or eight tiers, the width of the manuals, and placed as near to them as possible. I will now read you what I have extracted from letters written to us by Mr. Barker himself, and show you the gradual development of his electro-pneumatic patent. I have dwelt at considerable length on the pneumatic lever, because, without it, electricity would have proved too costly to apply to organ mechanism.

It was in 1832 that Mr. Barker, then established as an organ builder in Bath, his native city, was led to reflect on the serious inconvenience arising from the extreme heaviness of touch in all large organs, and more particularly exemplified in that recently constructed for York Minster.

Mr. Barker's persevering studies having revealed to him an efficacious remedy for this defect, by the invention of what has since been called the "pneumatic lever," he wrote in 1833 to Dr. Camidge, then organist of York cathedral, announcing his discovery, and begging to be allowed to give proof by applying it in a temporary way to one of the heaviest keys in the organ. Dr. Camidge's reply was, "For such an instrument as ours your invention would certainly be very important, especially where four organs have to be played occasionally by one set of keys, and I shall be most happy to recommend its adoption. Mr. Hill, of the late firm of Elliott and Hill, has erected our organ, and I assure you the playing of it is no sinecure; indeed it is most laborious work to go through a chorus or last voluntary with the whole power of the organ. Such a difficult touch as that of York cathedral organ is doubtless sufficient to paralyze the efforts of most men, and with all the energy I can rally about me I am sometimes inclined to make a full stop from actual fatigue, in a very short time after the commencement of a full piece."

Notwithstanding Dr. Camidge's wish and recommendation, financial difficulties stood in the way of Mr. Barker's invention being adopted in York, and he was not more successful in his propositions for applying it to the Birmingham Town-hall organ, opened in 1834 or 1835. About this period the eminent French builder, M. Cavaillé, was occupied in building a colossal organ for the Royal Church of St. Denis, near Paris, and it was already sufficiently advanced to convince Mr. Barker that for heaviness of touch it would rival, if not surpass, the

York Minster or Birmingham organs; indeed, it was doubtful if any organist of acknowledged talent would risk his reputation by attempting to play upon it. Mr. Barker immediately wrote to M. Cavaillé to propose the introduction of his pneumatic lever, accompanying the letter with a certificate from his late lamented friend Mr. Merrick, who had played on a small instrument fitted up for demonstration, each key of which presented a resistance of several pounds—this was in 1837. M. Cavaillé wrote a polite letter in reply, and engaged Mr. Barker to come over to France and examine as to the possibility of applying the invention to his magnificent organ. Mr. Barker acceded to this request, and the pneumatic application was decided on under his immediate superintendence.

However, in order to establish priority as the inventor, and at the same time protect his interests before doing anything more in the matter, Mr. Barker took out a French patent, in 1839, and soon after the pneumatic lever was applied with the greatest success, and, for the first time, to the St. Denis organ. After having entered into an agreement with M. Cavaillé to grant him licences under the patent, the application was introduced at St. Roch, La Madeleine, St. Vincent de Paul, and St. Clotilde. Mr. Barker's connection with M. Cavaillé then ceased, and he was led to undertake the direction of a large organ building establishment, recently formed in Paris by a company under the name of Doublaine and Callinet, where he had frequent opportunities of introducing his invention.

This company having been dissolved in 1845, Mr. Barker undertook to carry on the business for M. Ducroquet, simply a capitalist who had purchased it, and built for him, among other important instruments, that of St. Eustache, and also the small but very complete organ which appeared in the French Deparment at the Great Exhibition, 1851, and for which M. Ducroquet received, in addition to the English prize medal, his nomination as Chevalier of the Legion of Honor from the French Government.

Here Mr. Barker notices two English organs in the Great Exhibition—that built by Mr. Willis, of London, presenting, for the first time, a complete specimen of the application of the pneumatic lever to the key-boards, although not made to act on the manual couplers as in the French organ; this large organ also offered the first example of the same principle applied to the drawstop action and combination movements, not reckoning a partial application of that nature to an organ in Bordeaux by Mr. Barker himself. Mr. Hill's organ had the pneumatic lever applied to the drawstop action too, but acted upon by positive and negative key-boards on either side of the manuals, in place of the usual drawstop knobs. The pneumatic lever was not applied to the key action, as light pallets of peculiar construction were introduced instead.

From the time of the Great Exhibition, 1851, English builders in general began to appreciate the advantage of the pneumatic system, and the more readily because it had appeared at the Exhibition with the required character of a foreign importation; in fact, workmen who had been familiarised with the construction of the lever in the shops of M. Cavaillé lent their aid and assistance, so that when Mr. Barker proposed to take out—alas! too late—a patent in England, he found he would only be bringing coals to Newcastle.

Mr. Barker further observes that the claims of priority which have been put forth by others must not be passed over in silence. In the first place, that of the late Mr. Joseph Booth, organ-builder, of Wakefield, who, it is alleged, introduced a contrivance of this nature at Brunswick Chapel, Leeds, in 1827: there is no reason to doubt the statements made to this effect by both his brother and son, but what remains to be proved is the identity and efficacy of his apparatus. Mr. Barker is not aware that there exists other than very imperfect data; a small bellows called a "puff valve" is said to have been placed in connection with one of the double grooves of the sound-board, and by its inflation by one of the pallets it acted automatically on the second. If this description is correct there would be evidently here the germ of the pneumatic lever, just as in the early trials of Papin was contained implicitly that of the steam-engine, perfected later by Watt, Stephenson, and others. But, in the one as in the other, how great is the distance which separates the elementary fact from its ultimate result; how great the difficulties to be overcome! While I am free to admit that Mr. Booth was in possession of a fruitful idea, he certainly kept his light under a bushel, that, sterile in its consequences, no one heard of it till 24 years after, when it had long ceased to exist. Mr. Barker denies all previous knowledge of this or any other attempt in the direction of his pneumatic lever, which, as constructed and employed by him, is well known to constitute a motive power directed by the finger of the performer to all the mechanical parts of the organ.

The foregoing remarks are in part equally applicable to the pneumatic apparatus of Mr. Hamilton, but with this difference, that he does not substantiate any claim to an application anterior to 1835, two years later than Mr. Barker's correspondence with Dr. Camidge. In the great Paris Exhibition of 1855, Mr. Barker was admitted an exhibitor on his own account, and independently of M. Ducroquet, who was then on the point of retiring from business, but for whom he had built for the last time and for this exhibition, an organ of twenty stops, three manuals, and separate pedal organ. In this instrument the pneumatic lever was turned to good account, and it enabled Mr. Barker to place all the powerful reeds of the great organ in a swell box, and so to obtain an unusually effective crescendo. At the close of the exhibition Mr. Barker was honoured with a first-class prize medal, and, moreover, nominated as Chevalier of the Legion of Honor.

Mr. Barker afterwards remained with M. Merklin, the successor of M. Ducroquet, till 1860, and then commenced business on his own account, in partnership with M. Verschneider, an excellent voicer, who had given proof of his talent in the harmonisation of the grand organ at St. Eustache, then considered one of the best in Paris. It might seem, in presence of the comparatively satisfactory results obtained by the pneumatic lever, that, as a means of facilitating execution on large instruments, nothing better could be wished for. This, however, is not so absolutely the case as might be inferred at first sight, as will fully appear from the following considerations:—The great defect of the organ, and especially large instruments with several key-boards, is the number and excessive complication of its mechanical parts, all of which, however accurately adjusted, are, from their nature, particularly subject to the effects of atmospheric influence; thus, under the effect of damp, the long trackers shorten, the various levers swell, and move with difficulty on their bearings; the solid framing which supports the sound-boards, by its variation adds to the general disorder; and continual "cypherings" are the unfortunate result. Every organist is aware that in summer the touch of his instrument is reduced to zero, and often totally inadequate to open the pallets sufficiently for the necessary supply of wind to the pipes, and by this means the organ is rendered out of tune, and, consequently, painful to the ear. To remedy as far as possible these serious inconveniences, the mechanical parts, or "action," of the instrument, are provided with regulating screws, to adjust such deviation, but how many difficulties have to be encountered in this delicate and tedious operation, rendered still more so by the introduction of the pneumatic lever and its couplers. No one except a skilled workman is capable of restoring perfection, and in many places such attention becomes expensive and troublesome.

It occurred to Mr. Barker, as it had already done to others, that, seeing what had been accomplished in telegraphy—by which the most delicate movements are transmitted to indefinite distances with rapidity and precision—it might be possible to apply the same principle to the organ. This he has actually accomplished, in the presence of repeated and uniform failure on the part of his predecessors, who entirely overlooked the most essential condition in the electric transmission—that is, either to diminish the resistance of the sound-board pallets to a minimum by means of an entirely new construction, or to attack them by the intervention of the pneumatic lever, reduced to a simple inflated bellows, commanded by the smallest possible disc-valves, and disembarrassed of all the usual accessories in the shape of couplers, which can all be now effected electrically. This particular form of pneumatic lever, adapted every way to the requirements of the electro-magnet, Mr. Barker has patented both in France and England.

It is now about five years since Mr. Barker made his first experiments for the application of electricity to the organ, and upon the favourable report of the commission charged to examine this new mode of construction, he proposed to apply it to the large organ he had just received orders to construct for St. Augustin's Church, Paris. This electric organ, containing three manuals, forty-two sounding-stops, and eight couplers, although not opened till June in the present year, has been erected in the new edifice more than fifteen months, and, consequently, subjected to great vicissitudes of temperature and damp, nevertheless the key-boards have not presented the slightest derangement or variation of touch. The commission having made another and final report in most favourable terms, Mr. Barker is now charged with the construction of another large organ for the new church, St. François de Xavier, Paris, and which is to be built on the electric principle, making, with those of St. Augustin, Salon. and Montrouge, the fourth application of the new electric system in France made by Mr. Barker.

Dr. Gauntlett, who had done much towards the introduction of the German or CC compass of organs in this country, now universally adopted, I believe may claim to be the first who conceived the idea of applying electricity to organ mechanism. The following notice occurs in the *Orchestra* of March 28th, 1868:—"The using of electricity as a motive power in organ building was first mooted about 20 years ago by Dr. Gauntlett, who at the time of the Great Exhibition of 1851 proposed a scheme for playing all the organs in the place at one and the same time. The plan met with great opposition, and nothing was done; but on the announcement of the Crystal Palace Company, Dr. Gauntlett met the Provisional Committee, and proposed the erection of *facsimiles* of the eight most celebrated organs in Europe, and playing them altogether or separately in the centre of the building. The original prospectus of the company put forth the exhibition as one of still life, and one which might be grasped in one view. All such exhibitions fail unless accompanied with music, and Dr. Gauntlett's proposition was to supply the place with a continual stream of music at an outlay much less than that for the maintenance of an orchestra. Messrs. Anderson and Fuller, two gentlemen of the committee, met the proposition with a decided negative. 'Dr. Gauntlett,' said Mr. Fuller, 'you will never hear a note of music in the Crystal Palace; the exhibition is intended for far higher purposes. We do not want music and we shall never have it!' And thereupon Dr. Gauntlett departed, but not without telling the committee that without music the whole affair would become bankrupt. Dr. Gauntlett patented his speciality in 1852, and in 1863 another plan was patented by Mr. Goundry. It is far from impossible to put a key-action under the dome of St. Paul's Cathedral, by which all the organs in London and its suburbs could be played at once, and if the clergy could be brought to celebrate the service in one time so that all the singing could be made to begin together, and one set of tunes could be found to satisfy all tastes, then the one organist in St. Paul's Cathedral would be fully sufficient for the Sunday psalmodic power of all London."

Dr. Gauntlett's patent of 1852 comprehends playing organs, both finger and barrel, as well as seraphines and pianofortes, through the electrical agency. For organs he proposed placing a powerful electro-magnet immediately beneath each pallet, and fastening the armature on the end of the pallet itself, an arrangement which would require too much space and an expenditure of electric force requiring an enormous battery to supply a sufficient current. He certainly mentions that an apparatus known as the "pneumatic lever" may be worked with the electro-magnets and armatures, but he does not describe any form of arrangement. The drawstop and swell action are also alluded to, but there is no explanation as to how they are to be accomplished. Dr. Gauntlett's contact at the key had the disadvantage of not acting till the key was quite down, and, being simply a touching contact, would become rapidly oxidised.

In 1863, Mr. Goundry, also an amateur, patented a very elaborate electric system, chiefly in connection with the introduction of the enharmonic scale, which requires forty sounds to the octave. He describes several known forms of light pallets, and proposes to open them direct by the electro-magnet in a similar manner to Dr. Gauntlett. The pneumatic lever is also mentioned, and a form given for its application. Mr. Goundry shows a very elaborate arrangement for coupling purposes, and also for throwing up the melody. In his drawstop action he proposes that a spring should pull the slider in, and that it should be drawn by a pneumatic power-bellows, actuated by an electro-magnet, around which the current of electricity would be passing all the time the slider remained drawn, thus involving a great consumption of battery power.

No organ-builder embarked in either of these patents, and no illustrations were attempted, probably because so many difficulties had yet to be overcome to render a success probable, and, moreover, the application required considerable knowledge of a science quite foreign to the trade. It is not surprising, therefore, that these patents, and also a notice which occurs in the preface of "Hamilton's Catechism of the Organ," published in 1865, excited no interest or attention, although, in the later publication, direct mention is made of Mr. Barker's St. Augustin organ as being electric, and that the choir organ was finished, and "played almost daily by different organists, who express themselves in most favourable terms."

During the Paris Exhibition of 1867, Mr. Augustus L. Tamplin called our attention to the St. Augustin organ, then nearly completed, and we at once recognised the impending revolution in large instruments, and finally arranged, on Mr. Barker's completing his patent in England early this spring, for the grant of sole concession in this country. In the meantime we determined to introduce the system successfully in England. Subsequently, at Mr. Barker's urgent request, we gave up the sole concession, as he afterwards thought, by being only in the hands of one firm, it would delay the general adoption for all large work, and, consequently, yield him less profit during his lifetime than if he were to grant concessions to whoever might require them, although we retained the full use of his patent.

Mr. Barker's English patent, taken out in January of the present year, protects his special arrangements of the following applications, which, with the exception of the drawstop action, are based on his actual experience, gained in the construction of three electric organs, which he had already erected in France.

1st. His arrangement of the electro-pneumatic action to the keys and pedals, including a method of making the contacts by means of immersing copper points in mercury cells.

2nd. A contrivance for coupling the various rows of keys as well as the pedals, either in unison or in octaves.

3rd. An arrangement for drawing the stops.

4th. The manner of commanding the large valves in wind trunks, known in England as ventils.

5th. An automatic system for suspending all waste of electrical agents in the battery when not actually in use.

Diagram No. 4 is an enlarged copy of the drawing attached to Mr. Barker's English patent, dated January 28, 1868. It represents the end section of a divided sound-board, such as would be used when two different pressures of wind are required, or where the number of stops is so great as to require two pallets to supply a sufficient quantity of wind. The chamber in the wind-bar is supplied with compressed air, and is continued the whole length of the sound-board. This is to supply the pneumatic power-bellows, which are all fixed externally on the bottom side of the sound-board, one of these power-bellows being provided beneath each pallet. Immediately below the air-chamber and upon the fixed table of the power-bellows is a small double-action disc-valve attached to a vertical rod. In a state of rest, as shown in the drawing, the top disc-valve is closed, cutting off the compressed air, and the lower one is open, so as to establish a communication from the interior of the power-bellows with the atmosphere, and allowing the sound-board spring to hold the power-bellows shut. The disc-valve is actuated by the armature of an electro-magnet placed below, and attached to the vertical rod, so that when the electro-magnet becomes excited by the current of electricity, and, therefore, attracts the armature, the position of the disc-valve is reversed: the lower one being shut and the top one opened, it allows the compressed air from the chamber above to rush in and inflate the power-bellows, which, being attached to the sound-board pallet, immediately pulls open the same. Directly the electric current ceases the armature is of course released, the disc-valve returns to its former position, the compressed air is cut off, the sound-board spring collapses the pneumatic power-bellows, and the air escapes by the bottom disc or exhaust valve, which is now open again.

The drawstop action for each slider in the sound-board consists of two large pneumatic bellows, acting alternately in opposite directions, the inflation of which is governed by two double-action disc-valves, worked again by small accessory power-bellows and two electro-magnets, acting positively and negatively.

A sound-board, therefore, with its electro-pneumatic power-bellows applied to both pallets and sliders, requires no train of moving mechanism to connect it to the key-board and drawstop knobs, however distant, but simply the necessary number of insulated copper wires to conduct the electric currents from the console, or stand, which holds the manuals, pedals, &c. The console, thus detached from the main body of the instrument, contains a vast amount of accurate and beautifully-arranged work. Its dimensions may be compared to those of a large harmonium; and, besides holding the various key-boards, it contains, first, the rocking-lever beneath each key, which, being furnished with copper points, plunges them in mercury cells directly it is depressed, and so establishes the electric current; secondly, the various couplers, which are bars of wood, on which are screwed copper springs for each note; when drawn by the knob these metallic springs press against corresponding copper-plates, and so cause the electric current to divide and actuate the additional electro-magnets and pallets at the same time; thirdly, the drawstop knobs and traces, to which contacts of a similar nature are attached, and which likewise complete the circuit of the electric current to their respective positive and negative electro-magnets; fourthly, all combinations which act mechanically upon the drawstop traces, and other accessory movements and pedals, &c.

To prevent the waste or destruction which would take place in a powerful and active battery if the electrodes were left immersed in the exciting liquid, it is necessary to lift them out of their cells when the organ is not in use, and as this operation would probably often be forgotten, the last provision of Mr. Barker's patent refers to a self-acting arrangement. For effecting this object, he places the jars containing the liquid on the top of a wind reservoir supplied from the main bellows, and suspends the electrodes in a frame above them; when the bellows are blown the reservoir becomes inflated, raising the cells so as to immerse the electrodes; when the wind ceases the reservoir gradually collapses, and the jars sink down, leaving the electrodes suspended dry above. Mr. Barker also protects the reverse action, the cells remaining stationary, and the electrodes being made to descend into the liquid; this is effected by the same agency, and amounts to the same thing. Mr. Barker does not patent a battery of his own, having found his requirements satisfied by modifications of more than one already known and in common use. The battery is not placed within the console, and close to the keys, as some have supposed, but in any convenient position within or near the organ itself.

From what I have already explained to you with regard to electric key action, you will have perceived that two intermediate agents are employed to make the depression of the key open the pallet in the sound-board, viz., electricity and pneumatics, and it will probably strike many at first sight, that such an arrangement would tend to cause a certain amount of delay or slowness in its operation. This, however, is not the case in actual practice; the velocity of electric currents requires no comment, and, in the short circuit we employ, electricity performs its work simultaneously with contact being made at the key. The pneumatic power-bellows, unlike those employed in a mechanical organ, where they have to be large enough to pull open several pallets at once, besides moving long trains of action, are now only required powerful enough to open one pallet, and are therefore so small that very little compressed air is sufficient to inflate them; moreover, their small and sensitive valves are not impeded by mechanical attachments. The practical result is, that no perceptible difference of time can be discovered between the depression of the key and the speech of the pipe. This is best proved by the excellent repetition touch obtained; in this it far surpasses any mechanical action.

It was, however, obvious that a great advantage and saving of work would be gained if, as Mr. Barker suggested, a perfectly new form of pallet could be contrived which would offer no resistance in opening, and admit of being acted on direct by the electro-magnet instead of being attacked by the intermediate pneumatic lever as heretofore. To effect this, we turned our utmost attention, and at length succeeded in constructing a pallet fulfilling all our requirements.

Diagram 5 is an enlarged copy of the drawing attached to our patent, dated April 6th, 1868, and shows the complete arrangement of our new pallet as applied in a single and double palletted sound-board; diagram 7 being further enlarged to show a section of this pallet I will first refer to it in order to explain the construction and method of working. The pallet consists of a small diagonal bellows, formed with top and bottom boards attached to each other by flexible leathern ribs. The upper side of the top-board is covered with soft leather, and forms the valve which beds close against the underside of the sound-board bar—it is kept in this position when at rest, by a common spring pushing upward from the fixed bottom board. The back or tail end of the bottom board is hollow, and is fitted into a square mortice in the wind-bar, through which a channel is continued to a chamber on the other side. The front end of the bottom board is fixed sufficiently below the top-board, so as to distend the leathern ribs nearly to their full extent. On the other side of the wind-bar are two chambers. The upper one runs the whole length of the sound-board, and contains compressed air of the same pressure as is supplied to the sound-board. The lower chamber is the one in communication with the interior of the pallet; it is partitioned off separately for each note, and contains a double-action disc-valve fixed on a vertical rod. The position of this valve determines the communication with the chamber above containing compressed air or the atmosphere below outside. In a state of rest the top disc-valve is open so that the compressed air from the chamber above is inside as well as around the pallet, and of course by its pressure holds the top-board firmly against the sound-board bar—indeed, if the wind could always be kept in there would be no necessity for a spring at all, which is only to keep up the top board till the pallet is inflated. The lower disc-valve is now closed, and prevents the escape of the compressed air. If the position of the disc-valve is altered and reversed by raising the vertical rod by means of the armature of an electro-magnet, the compressed air is at once stopped from entering the interior of the pallet, and the pressure on the outside of the leathern ribs collapses them, and they draw down the upper board and allow the wind to enter the groove of the sound-board, and thence, if the sliders are drawn, supply the pipes above. The air in the interior of the pallet is allowed to escape into the atmosphere through the lower disc-valve, which is now open. When the vertical rod is released by the armature of the electro-magnet, the disc-valve returns to its original position, the escape-valve is closed, the compressed air again enters the interior of the pallet and shuts it firmly against the sound-board groove. In cases where it may be considered necessary to open the pallet very wide, as in pedal sound-boards, &c., a third chamber, running the whole length of the sound-board, from which the air is exhausted, could be placed beneath the lower disc-valves instead of allowing them to open direct into the atmosphere; the top-board would then be drawn hard down on the bottom-board, which can be fixed at a greater distance, and thus secure either a horizontal or diagonal opening to provide a great supply of wind to the sound-board groove for distribution to the pipes.

Our new pallet may appear to some to resemble a form known for many years, and I believe used in several instances by both Messrs. Gray and Davison and Mr. Willis for pedal sound-boards, but in reality it differs widely in its condition and mode of action, inasmuch as it is held closed by the pressure of wind in its interior, and opened by the disc-valves allowing this wind to escape or exhaust, so that the pressure around it is enabled to force in the ribs of leather, which in yielding actually pull the top-board away from its seat against the sound-board bar, whereas the old form of pallet just alluded to had ribs sufficiently distended only to counterbalance the resistance of the wind, and was pulled open by a connecting link in the same way as an ordinary or common pallet. Neither disc-valves nor attenuated air were used in conjunction with it, and the interior was in communication with the atmosphere instead of being filled with compressed air when in a state of rest. In our pallet we gain the advantage, that when closed it has the full force of the wind to press it soundly against its seat, and thereby prevents any tendency to leakage, a fault common to all other compensating or balanced pallets, which must be closed by strength of the spring. Again, the ribs of our pallet, being distended to their full length when at rest, present the most favourable position for being acted upon by the compressed air in the sound-board directly the escape-valve is opened, at which time the first movement of the pallet from its seat requires most force to be expended. Any single pallet can be easily taken out for repair by raising it from the fixed rail in front, and pulling it out of the mortice in the wind-bar, as no pull-down, link, or connecting rod is attached to it, and guide pins are unnecessary. These very frequent causes of derangement are thus entirely avoided. The dimensions of our pallet can be varied from that required for the smallest treble note to the largest necessary for any pedal sound-board. It is equally available for mechanical and non-electric action, in which case a spring would have to be introduced just sufficiently strong to return the key and action; this would constitute all the resistance presented to the finger of the performer. The cost, as well as the space required, is less than when the ordinary pallet is employed with a separate pneumatic power-bellows placed externally.

In most cases where organs already built are to be reconstructed on the electric system, the old arrangement of the sound-boards will prevent our new pallet being conveniently used; we have therefore found it best to apply externally a pneumatic power-bellows beneath each original pallet, similar to Mr. Barker's arrangement, but placed in two tiers, to get them in in the length of the sound-board. These we have worked with exhaust or attenuated air instead of pressure, for the following reasons:—The ribs or sides of pneumatic power-bellows, if not made very rigid, and lined with cardboard, are subject to being overstrained and inverted when inflated, and thus either locked open or destroyed. If made stiff enough to be secure from this defect, they will not work as freely as desirable in the treble or smaller sizes. By the use of exhaust instead of pressure, no stiffening for the ribs is necessary, the cost of manufacture is reduced, and greater durability and freedom from noise are attained. I am not aware, nor can I hear, that exhaust or attenuated air has been proposed or applied for pneumatic power-bellows by anyone but ourselves. I should mention, however, that Mr. Willis took out a patent almost simultaneously with our own, in which exhaust and pressure are proposed to be employed alternately for actuating what he terms a "floating valve" in connexion with a novel arrangement of drawstop action. From the way in which provisional patent specifications are lodged it is impossible either of us could be aware of the conclusion arrived at by the other; and it is a singular coincidence, that a new principle in organ-building, which is likely to be of great service for intermediate purposes, should have been thus introduced for the first time. We were led to adopt exhaust for reasons already stated, and because the saving effected in a single power-bellows, however small, was a great consideration in the aggregate or large number employed in electric organs.

Diagram 6 shews the section of two electro-pneumatic arrangements, as patented by us, for moving the sliders. In large organs, where highly-compressed air is used for supplying certain stops of pipes, as well as exhaust-bellows for working the pneumatic key-action, we have used the arrangement shown in the left-hand figure, and the method of its action is as follows:—A large pneumatic power-bellows, connected by a lever and trace to the slider, is fixed on a table, and at the back of this table are three chambers. The top one is supplied with compressed air, and the bottom one has the air exhausted from it. The middle chamber communicates with the interior of the power-bellows, and also with either the top or the bottom chamber, according to the position of a large double-action disc-valve. The drawing shows the top chamber cut off by the valve being closed, and the bottom or exhaust chamber in communication. The power-bellows are therefore collapsed, and the end of the lever drawn to the right-hand. When the double-action disc-valve is reversed the exhaust-chamber is cut off, and the communication opened with the top or pressure chamber; the compressed air rushes in and inflates the power-bellows, causing the end of the lever to be moved to the left-hand. To gain rapidity of action it is necessary that the ports covered by the double-action disc-valves should be of considerable size, and also that the valve itself should have a movement of at least one-quarter of an inch. As this would require a very powerful electro-magnet, and great expenditure of battery power, it is found advantageous to introduce a small accessory pneumatic power-bellows.

These are placed immediately under and attached to the rod carrying the large disc-valve, and its position will be determined by their inflation or collapse. These accessory power-bellows are commanded by a very small double-action disc-valve attached to a vertical rod connected to the double armature of two electro-magnets; the chamber above this small double-action disc-valve is supplied with compressed air. The drawing shows that the left-hand electro-magnet was last used. It attracted its end of the double armature and the little double-action disc-valve, admitting the compressed air to inflate the small accessory power-bellows. When the right-hand magnet is actuated the small double-action disc-valve will be drawn down, the compressed air will be cut off from, and allowed to escape by, the bottom valve from the accessory pneumatic power-bellows, which will immediately collapse. The two electro-magnets are connected to the positive and negative contacts of the draw-stop trace in the console by insulated copper wires. In organs, when highly-compressed air is not required for other purposes, we avoid the expense of constructing such bellows expressly for working the drawstop pneumatic power-bellows, and obtain both the on and off movements from the exhaust alone. For this purpose we have employed the arrangement shown in the second figure, diagram 6, and we find it acts most satisfactorily. Two large pneumatic power-bellows are coupled together with a connecting rod in such a way as to ensure the expansion of one on the collapse of the other. Three chambers are placed between their fixed tables; the centre chamber has the air exhausted from it, the top chamber is in communication with the left-hand power-bellows, and the bottom chamber with the right-hand one. The communication of these chambers with the middle one is alternate, and governed by two double-action disc-valves, arranged similarly to the one in the first figure already explained. These are also commanded by small accessory pneumatic power-bellows and two electro-magnets in the same way as before described; therefore, as the contact is made at the console, the corresponding power-bellows is collapsed, drawing the slider in the desired direction. As combination pedals are not used in France but only ventils, which cut off and introduce the wind to certain groups of stops by means of pedals, we have, therefore, had to provide in our patent for an elaborate system of combination movements when required, as in England these most useful accessories for changing the stops are held in high estimation by our organists. I must, however, pass over what would otherwise take some time to explain, and only remark that electricity is most favourable for the extension of combination movements in novel ways. No insurmountable difficulty stands in the way of opening the swell louvres by means of an arrangement of electro-pneumatics, but as it is necessary for the purpose of gaining a gradual crescendo effect to employ more than one electro-magnet, and as the electric current would have to be in circulation around them during the long intervals that the swell is locked open, it becomes an expensive arrangement as far as battery power is concerned. We have, therefore, adopted a hydraulic means of communicating the motion of the swell pedal at the console to the swell louvres at the organ. To effect this we use two small brass cylinders, one placed immediately under the pedal, and the other beneath the connecting-rod of the swell louvres. These two cylinders are connected together by a small lead pipe filled with water. When the plunger at the pedal is depressed, the one under the swell is raised to a corresponding degree,—the motion being as much under the control of the player as if a connecting-rod was carried through, and of course with far less friction in long distances. The principle has been used with success in connection with the steering of vessels: we do not therefore claim it in our second patent as an invention, but as a new adaptation to the organ.

In the first organs we built on the electric system, we were unable to overcome a certain difficulty connected with the drawstop action, which did its work perfectly, except under the following circumstances:—If the knobs at the console were moved at a time either before the blowers had commenced or after they had ceased, no corresponding movement of the sound-board slider could of course take place, therefore the organist would be misled as to the real position of the sliders. It was also possible to move the knob so rapidly that the large pneumatic power-bellows had not time for inflation, before the momentary contact had again broken. I am glad to say, however, these shortcomings no longer exist, as we have invented an arrangement which provides that, however quickly the knobs are moved either singly or collectively, the contact will be prolonged to any length of time found necessary to ensure the inflation of the large pneumatic power-bellows, and also on the bellows being filled every slider will be moved so as to correspond with the position of the knob to which it belongs, although these may have been moved during the time there was no wind in the organ. I cannot now explain how these important improvements are accomplished, as they are not yet protected, and it would be therefore unfair to ourselves to do so until they are patented. They render the electric drawstop action as certain as the simplest form of a mechanical one.

I have now explained in detail, somewhat minutely, the construction of an electric organ, as regards the sound-board, key and drawstop-action, combination movements, method of opening the swell box, automatic battery attachment and console; the grouping of these parts so entirely depends on the nature and extent of the organ which is to be built, that it is impossible to present any diagram which will show properly the relative positions they will occupy as an entire instrument.

Before dismissing the matter of construction, it will be as well to observe that the battery employed is simple, inexpensive, and easily replenished by any careful person. It will not require attention more than four or five times a year. There are no grounds for supposing electricity to be a treacherous or uncertain agent. It is well known that chemicals of the same quality will, under similar circumstances, give the same result in their action. Ample notice of any decline in the power of the battery is given by the galvanometer placed in the console for that purpose, which serves as well to show whether or not the wind is in the organ, as indicated by the immersion of the electrodes. Thunder storms, or the electric condition of the earth, have no effect on an electric organ, as earth currents are not employed as in telegraphy. The adoption of electricity and insulated wire to replace or supersede the mechanical action in large organs is not merely a new process to attain the same end, but, independently of the suppression of a multitude of moving parts, many new advantages are presented otherwise unattainable. The touch is more delicate, rapid, uniform, and invariable. The durability is increased owing to the absence of wear and tear. The key-boards can now be placed at any required distance from, and quite irrespective of, the relative position of the organ; therefore the organist may choose a position where he can hear the effects he produces, and the voices he leads or accompanies, without in any way increasing the complication or proportionate liability to derangement. Many positions can now be utilized with the grandest effect that were formerly utterly impracticable. Powerful west-gallery organs may be played from the east end of the church, entirely through a cable of insulated wire an inch in diameter, or attached to additional manuals provided for that purpose at a mechanical organ placed close to the choir. Again, in Catholic churches, an altar organ, to accompany the priests, can be similarly played from the west-gallery organ, and thus one organist will be able to accomplish the duty performed by two, as in foreign churches. Many other novel dispositions and architectural arrangements suggest themselves now as perfectly practicable.

The electric principle is applicable to the reconstruction of organs already built, in which case all existing mechanical action is thrown away, and consequently it becomes more expensive than when applied in new organs. The cost must necessarily exceed that of ordinary construction, unless similar conditions are imposed, in which case comparison will be favourable, although in addition much more valuable and imperishable materials are employed in the electric organ, and the larger it is the less the proportionate cost of the application, besides the greater the advantages gained. I do not consider that the mechanical or ordinary organ is likely to be superseded up to a certain size, that is, not until it becomes too large and heavy to play with ease, or its position requires the removal of the manuals to a distance, although the new system could be applied to smaller instruments with equal success. Should the manuals not require removal, but occupy the ordinary position, close to the organ, an electric key-action, to ensure a light touch, may be employed with a mechanical or common drawstop-action, and so save expense.

Our first electric organ was built for Her Majesty's Opera, Theatre Royal, Drury Lane, carried on there on account of the destruction of the old house in 1867. This organ, erected within three months of the time we obtained the concession from Mr. Barker, was placed behind the scenery on the O.P. side, fifty feet away from the key-board, which was in the orchestra, where the organist could see the conductor and instantaneously realise his suggestions and directions. It was first publicly used the 25th of last May, and continued in operation till the end of the season without the slightest derangement or requiring attention. We then erected it in the Polytechnic Institution, Regent Street, where it has been performed on twice daily ever since. This was the first organ which had an electric drawstop-action and a cable of insulated wire through which it was played. No such example yet exists in France.

The next was built for Christ Church, Camberwell. It contains two manuals and independent pedal organ, twenty sounding stops and five couplers. It stands above the vestry, in a chamber on the south side of the chancel, and the console is on the opposite side amongst the stalls for the choir; fifty-five feet of cable intervenes, and runs beneath the encaustic tiles, passing through a drain pipe provided for it. Exhaust is used for the key pneumatics, and exhaust and pressure for the drawstop-action. This organ was previously erected for the Festival, Gloucester Cathedral, Sept. 7th, during the present year. We have nearly completed the reconstruction of the large organ in St. Michael's, Cornhill, and the swell organ of twelve stops has already been in use since the re-opening of the church last November. This fine instrument contains three manuals and independent pedal organ, thirty-seven sounding-stops, and seven couplers. The console is opposite, and facing the organ at a distance of thirty feet, thus placing the choir between the organist and organ. The cable contains 336 insulated wires and measures 1¼ inch in diameter; it is carried through a small drain pipe under the chancel floor, and this constitutes, with the exception of the lead pipe for the swell cylinders, the only connection between the organ and the console. Exhaust is used for the key pneumatics, and exhaust only for the drawstop-action. We shall shortly finish a large electric organ for St. George's Church, Tufnell-park, to be placed over the west door, and we have others in course of construction for St. Augustine's Church, Highbury, and Her Majesty's New Opera House, Haymarket, all on the electric system.

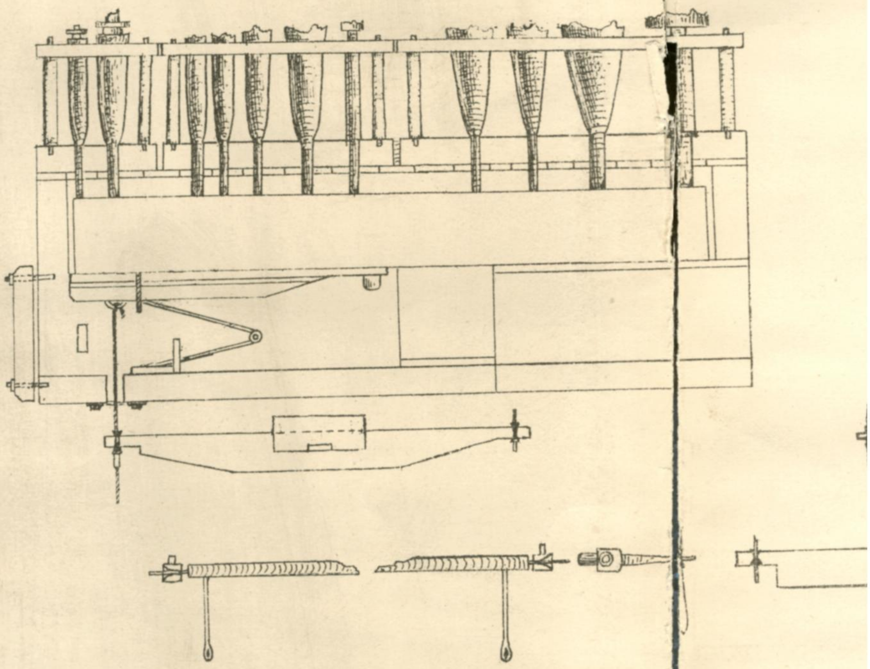
From what I have put before you it will readily be admitted that during the ten months which have elapsed since the concession was obtained from Mr. Barker, we have had many difficulties to surmount both in the matter of construction and as to the successful introduction or establishment of an entirely new system. I see, however, no reason to doubt its ultimate adoption for all grand organs, simply for the reason that it presents so many advantages without a single drawback or limit to the application. I have not experienced the prejudice against the innovation which I contemplated. So little did I expect the prompt acceptance accorded, that, in addition to the work I have before enumerated, we actually made the sound-boards of a large electric organ of forty-two sounding-stops and ten couplers, simply to illustrate the system. On obtaining actual orders this was of course thrown aside. Enough has been said to show what electricity has already accomplished in its application to organ building, and it is only reasonable to suppose that it will gradually develope new and far greater resources to be placed at the disposal of the organist.

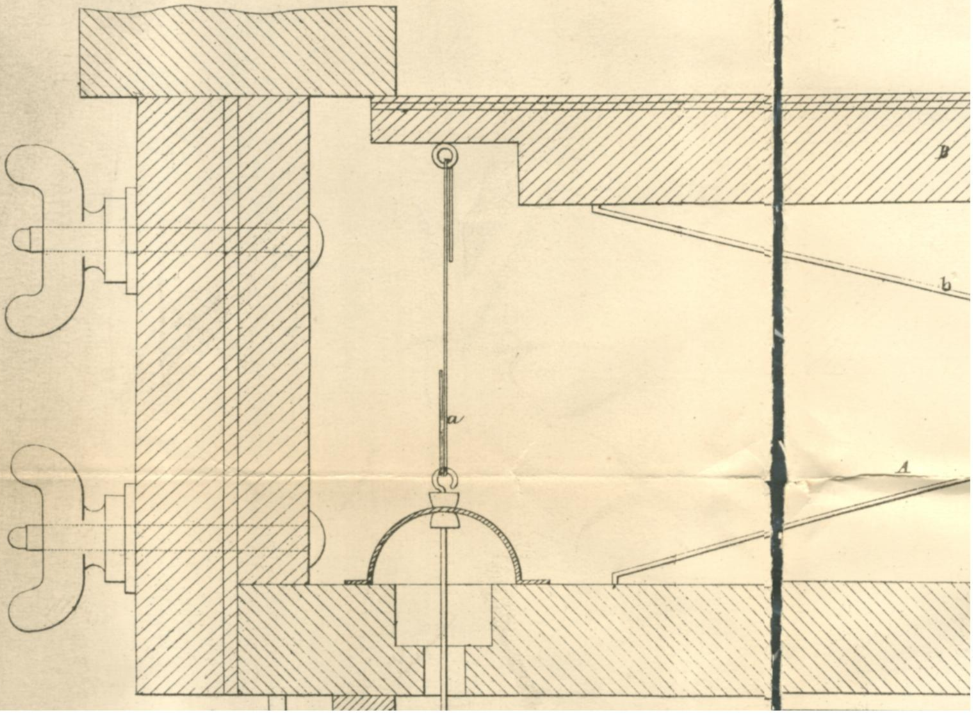
In conclusion, I would only remark that the unfavourable comparison often made between English and foreign organs is entirely owing to the different conditions under which we are placed. Abroad, the churches or cathedrals are comparatively few but large, and the organs are costly and slowly built; whereas in England the reverse is the case. The positions assigned us by most architects are decidedly bad, and it is a great mistake to suppose that, by increased pressure of wind and loud voicing, the tone of an organ can be forced from some obscure chamber, or position, because it was built for, or may be convenient to receive, the organ. There is little doubt but that the old west-end or screen positions are, after all, the finest and most central for allowing the waves of sound to traverse the whole building, with the least obstruction. I am sure other organ-builders will endorse these assertions as difficulties we all labour under alike. Moreover, the present mode of ordering organs through committees and competition often results in the selection of the specification which contains the greatest number of pipes, or else the lowest tender for a scheme which has been previously proposed; the result is the production of wooden organs, more like Dutch clocks than of the type of time-piece or chronometer. From the great variety of construction employed in organs, the mechanism cannot be produced by machinery or in large quantities, and, with the increase in the cost of labour, a liberal price must be paid, if a fine organ is really desired. There are several English builders who can produce organs equal or perhaps superior in tone to those abroad, but the truth is they seldom get the chance of free action and a good building to place the instrument in.

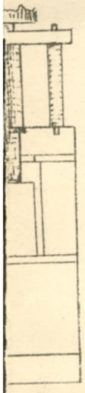
I have said much about Mr. Barker and ourselves this evening, but it must be remembered that up to the present time the electric organ has been only in his or our hands. I could not therefore draw on other experience. I have endeavoured to show that Mr. Barker has twice created an era in organ-building, and to him our organists are indebted for the luxurious ease with which they can now manipulate the most gigantic organ. Although Mr. Barker has received the decoration of the Legion of Honour—a decoration he could not have hoped for had he remained in this country—he has not received the more substantial recompense deserved by one who has spent a life-time in advancing art in a branch of industry too little understood to be appreciated as it deserves.

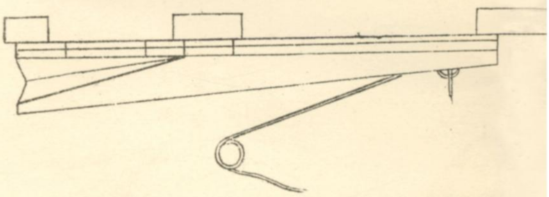
I must record my best thanks to Sir Charles Wheatstone for many hints and suggestions; to N. J. Holmes, Esq., for his valuable assistance and advice; and to H. Bramber, Esq., for questions of chemistry in connection with the production of electricity. I am afraid that the day of the week, and its close proximity to Christmas, have prevented many organists from being present, but I trust there may be some here who will offer their experience or put forward any doubts they may entertain in their own minds as to the application of the electric system to organ building.

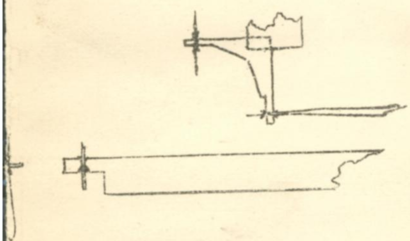
FIG. 1.

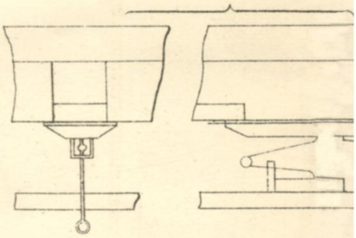


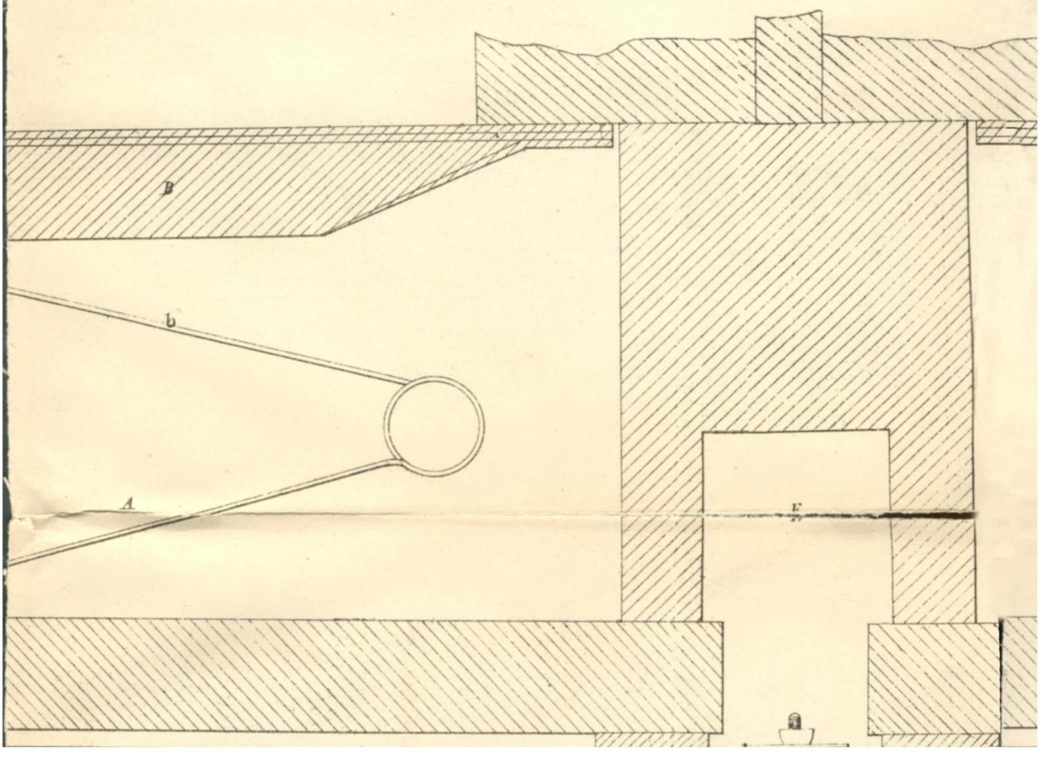




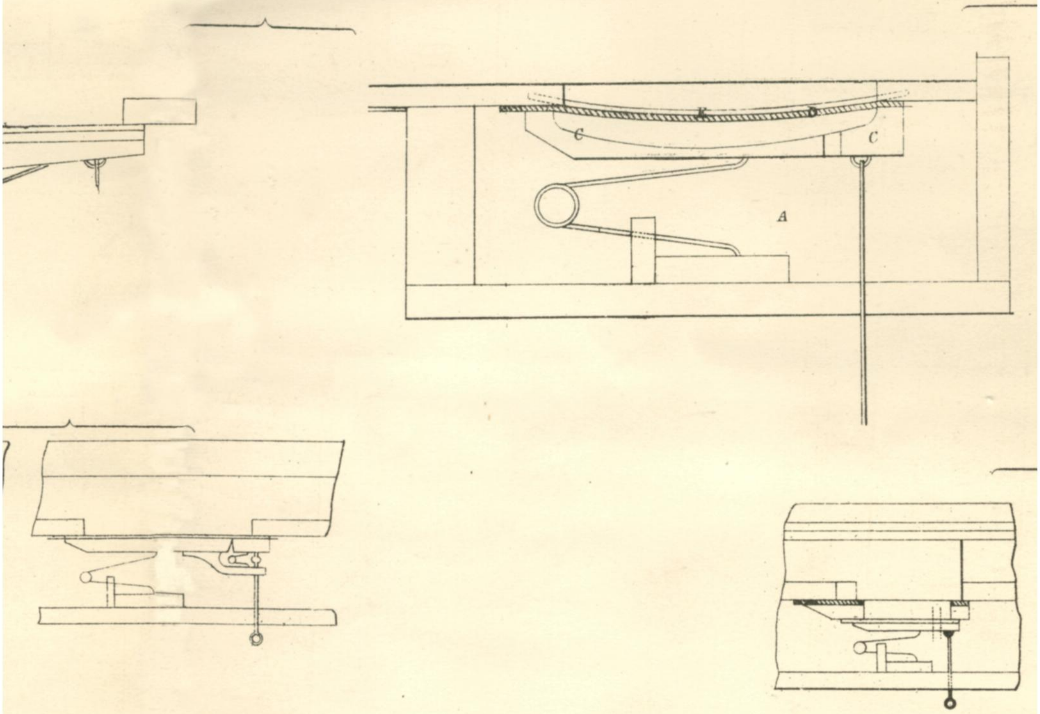







B
b
A
E

FIGˢ 2.



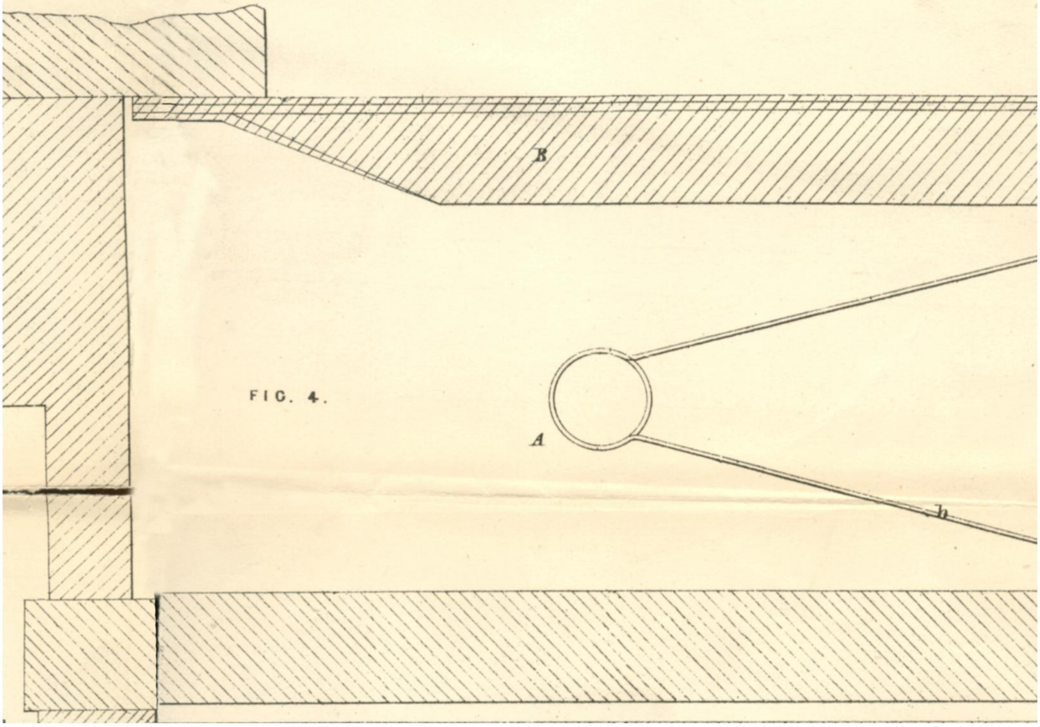
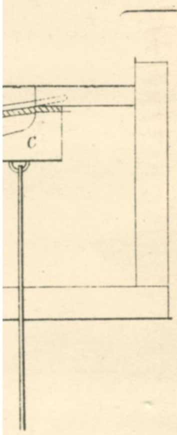
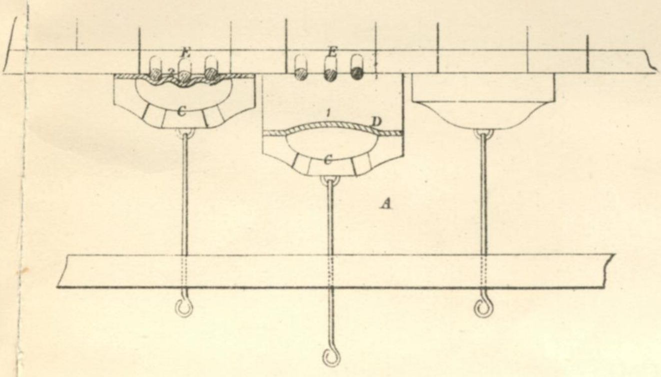
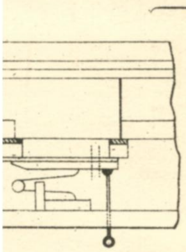
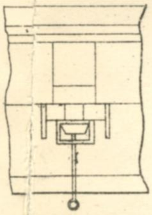


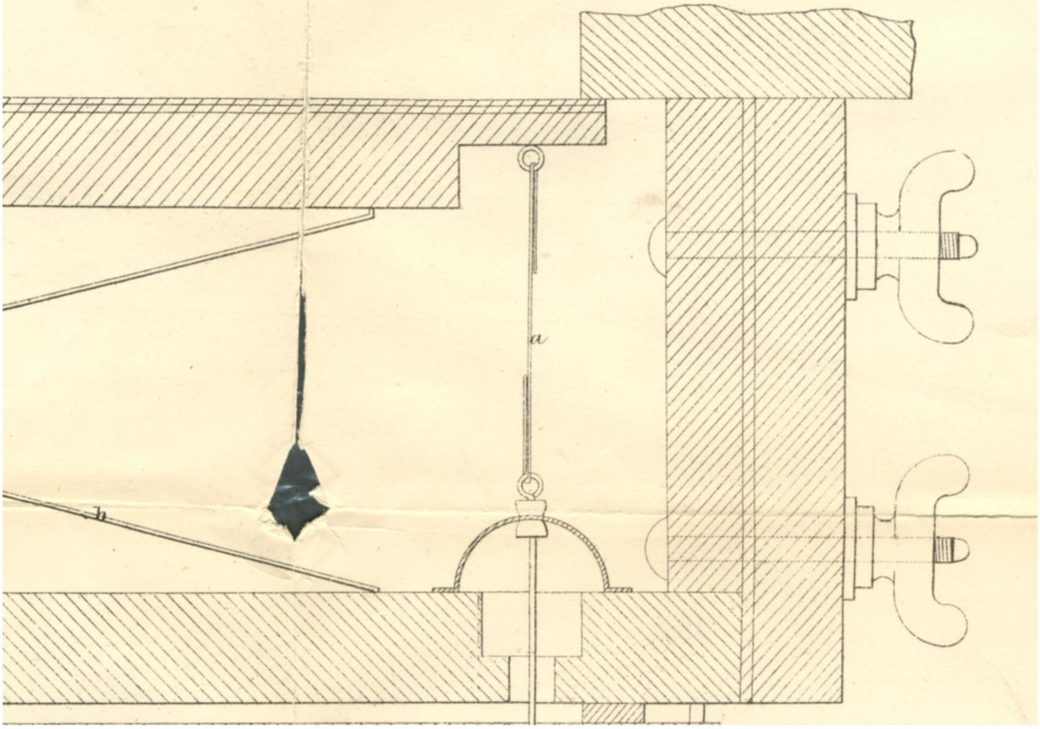
FIG. 4.

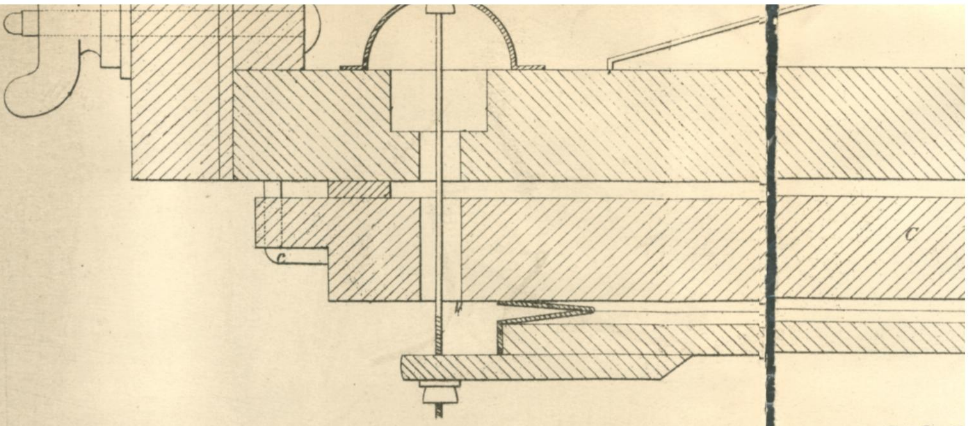

C


E
2
E
C
1
D
C
A






a
b



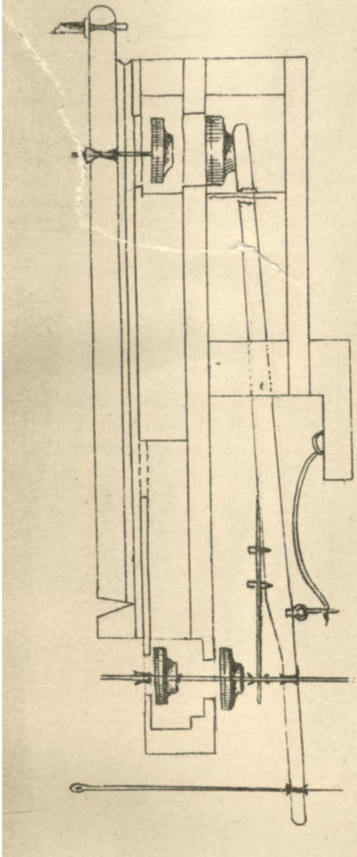
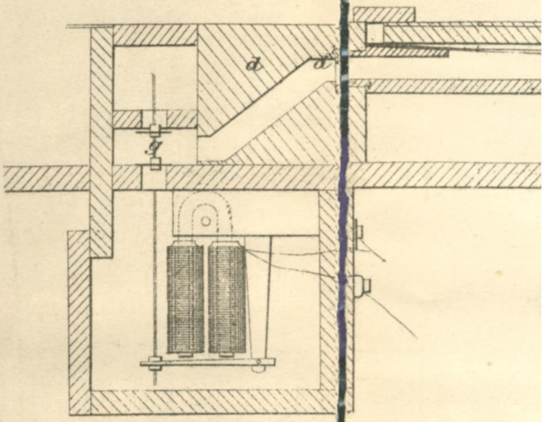
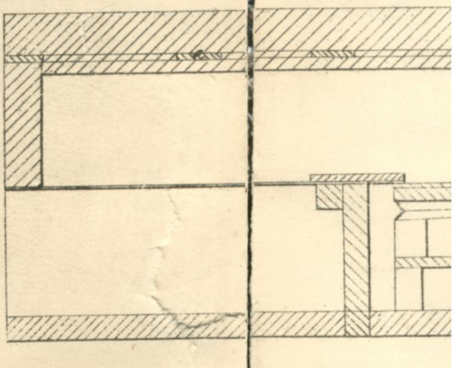


FIG. 3

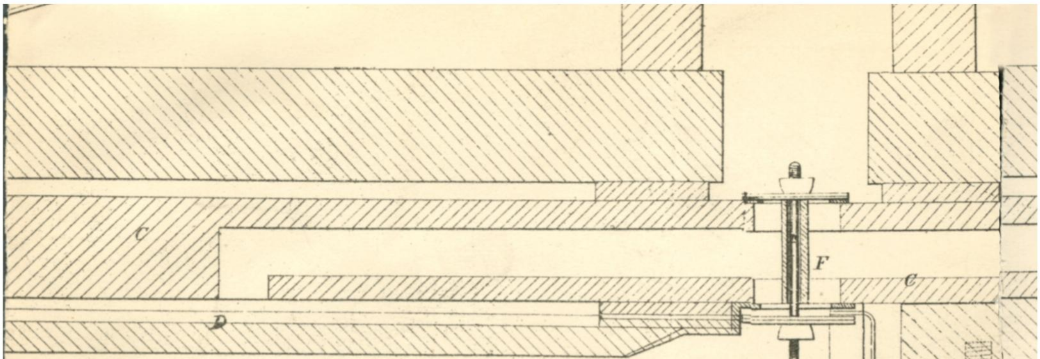
FIG. 7.





Diagrams illustrating Mr BRYCESON'S *Paper on the Electric Organ*

Journal of the Society of Art, and to be bound therewith.



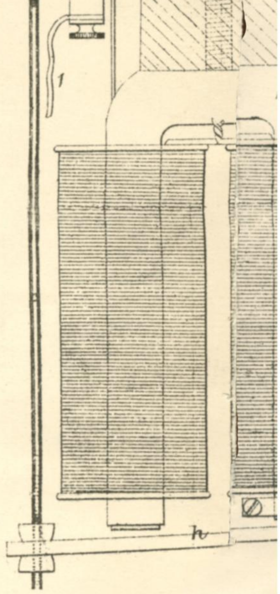


FIG. 7.

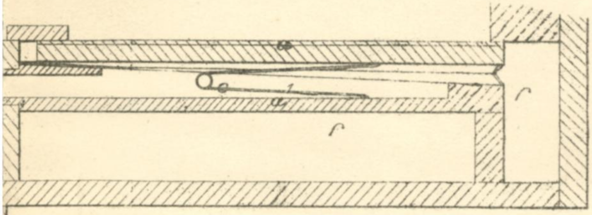
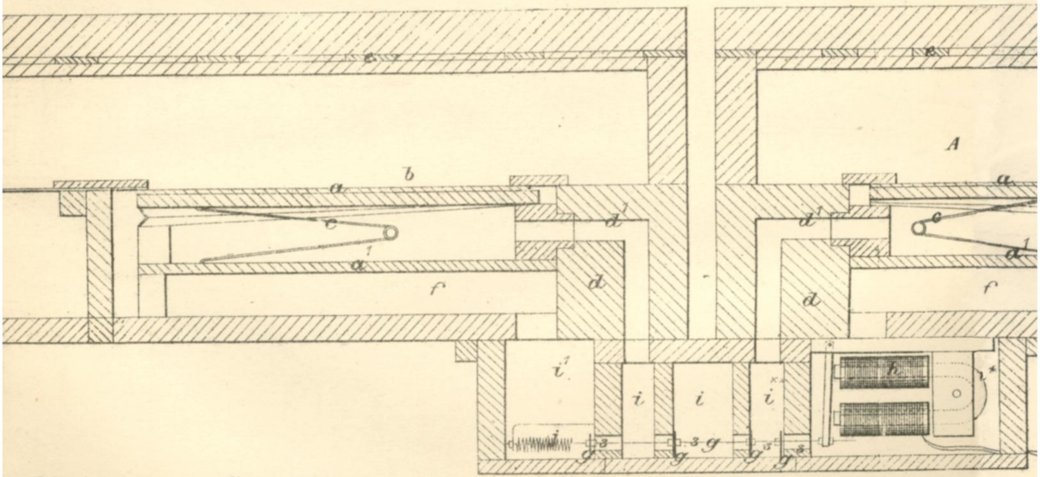
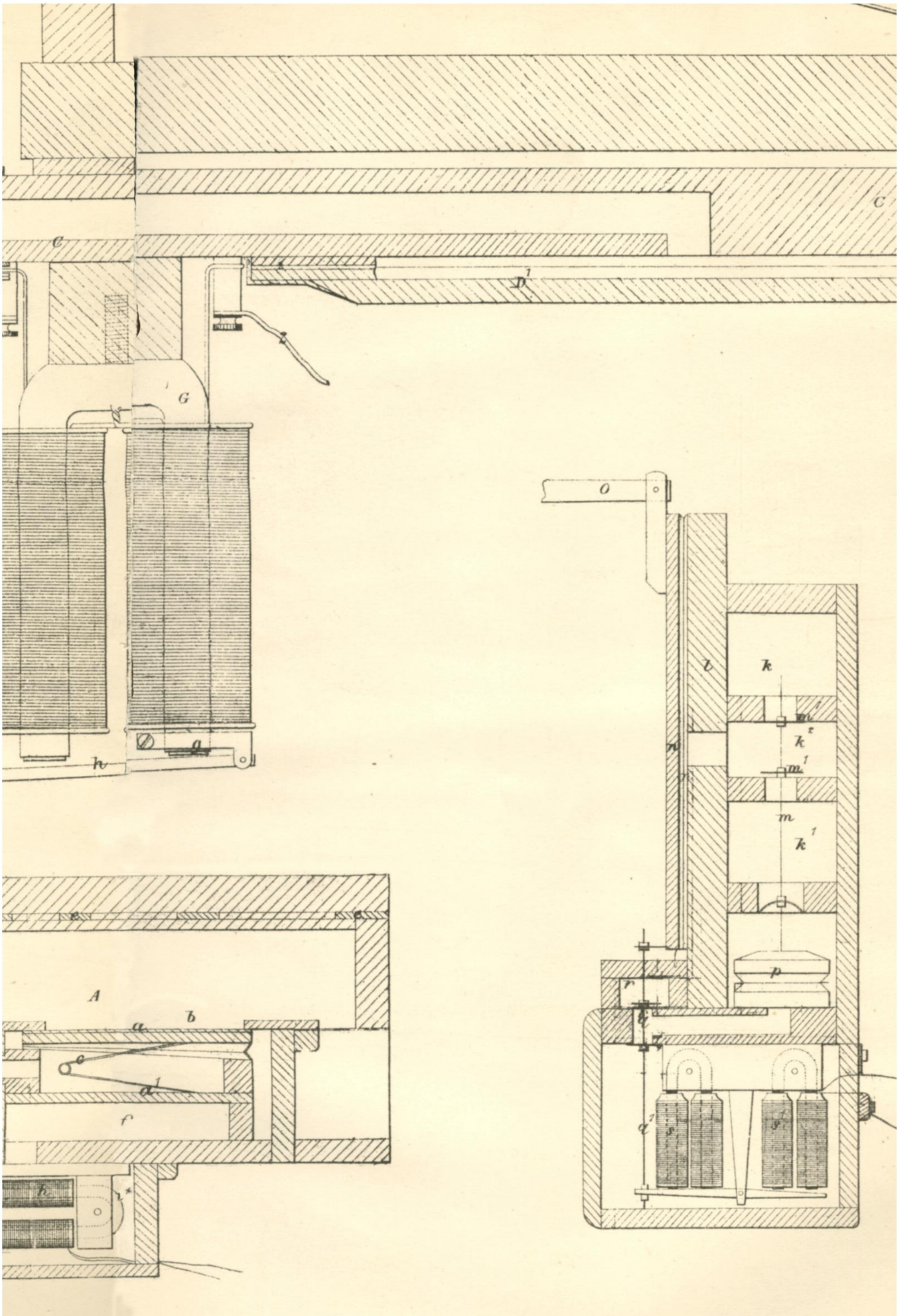


FIG. 5.

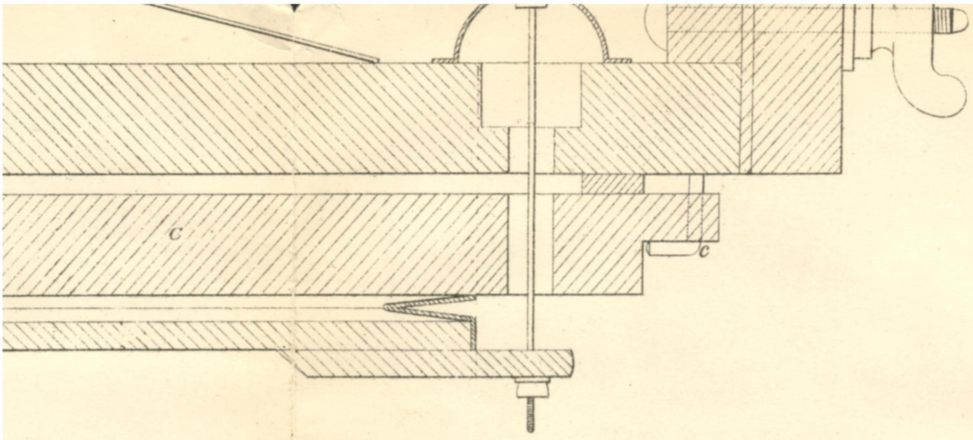


e Electric Organ N° 840 of the

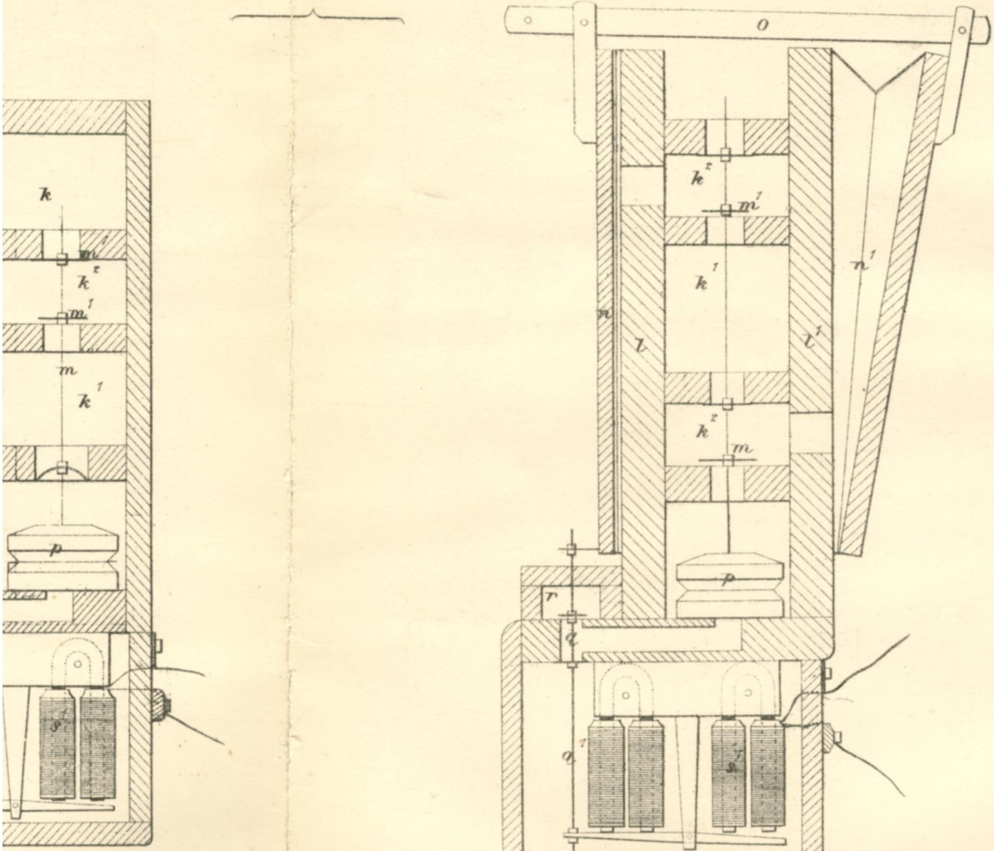
ewith.



C
c
D¹
G
g
h
O
l
k
m¹
k²
m¹
m
k¹
n
p
r
A
a
b
c
d¹
f
e
s
s¹
d¹



FIG^{s} 6.



DISCUSSION.

Mr. Forster (of Hull) wished to correct a few errors Mr. Bryceson had made in the historical portion of his paper. The first light touch-valve was made by Sebastian Erard, in 1827, and exhibited by him in Paris, in 1830; it was jointed like a backbone, and had several springs.* For the pneumatic movement there were two claimants, viz., the late Mr. David Hamilton, of Edinburgh, and Mr. Barker, who each brought out the movement in the same year (1830). Mr. Hamilton applied it to an organ in Edinburgh, in 1835, and read a paper on the subject before the British Association in 1836. The round or mushroom valves were used by Mr. Hamilton in his original model, which he (Mr. Forster) had in his possession sixteen years since. With regard to the electric organ, he was afraid Mr. Barker's principle, as shown in the drawings, would not be easily applicable, inasmuch as the pneumatics, being placed side by side, would extend the sound-board to nearly sixteen feet in length, a space that would never be given in English churches or chapels. The pneumatic drawstop-action was too complicated, required a double pneumatic, would be too expensive, and not always certain in its action. This fault applied both to Mr. Barker's and Messrs. Bryceson's patent. The sound-board valve, shown in Mr. Bryceson's patent, was not altogether new; it was described in principle in Roret's "Encyclopédie," also in Professor Töpfer's "Organ Manual," and was called the box-valve. The exhaust of the valve he (Mr. Forster) considered new and a really good thing. Much credit was due to Mr. Bryceson for the trouble he had taken in this matter, and his perseverance ought to be rewarded, though he feared the great cost of the electric movement, which was admitted to be 25 per cent. over and above the ordinary organ, and also the great continuous after cost of keeping the movement in order, might be a bar to its introduction.

Mr. Cooper inquired whether he had rightly understood Mr. Bryceson, that an electric organ would only require attention about four times a year?

Mr. Bryceson said he had spoken with as much accuracy as he could on this point. Of course the answer to such a question would depend on the amount of practice. Allowing for Sunday services and a fair average amount of practice, he believed his statement would be found substantially correct. He knew that there were strange rumours current that an electric organ required daily or weekly attention, but such was not the case. Mr. Barker had an organ under his care at a small country town near Marseilles, which he only attended to once in six months, when he tuned it. The electric organ had not been introduced into England long enough to enable him to speak from any extended experience of his own.

Mr. Cooper, as an organist, was delighted to hear of any improvement which would give ease and facility in playing, but he was informed, by a pupil of his, that on going one Sunday to St. Michael's, Cornhill, when the hymn was given out, the organ would not speak.

Mr. Bryceson said the simple explanation of that circumstance was that the men did not blow the bellows, and in proof of that assertion he could refer to either of the churchwardens. The console was only a temporary one, and was not furnished, as usual, with a galvanometer or wind indicator, so that the organist could not discover that the wind was not on. As to the expense of maintaining the battery power, he might mention that the organ at the Polytechnic, which was played upon twice daily, cost about 24s. per annum for electric power. In order to set that question at rest, he might add that in any electric organs which he built he would undertake to include the expense of replenishing the battery in the ordinary charge for tuning. It should be remembered, however, that these organs were not proposed as particularly suitable for small places, or where there was no money, although the system was applicable even to a single stop, and a suggestion had in fact been recently made to him for producing a particular effect, by placing one stop of an organ in a part of a church at a considerable distance from the rest of the instrument. The larger the organ the greater would be the proportionate economy.

Mr. Cooper said that having to play a large organ with 48 stops, which it would be extremely convenient to have commanded by a key-board in the chancel, he had naturally felt a great interest in the subject, and he was happy to say that the answers given to his inquiries had been quite satisfactory.

Mr. Beer asked permission to put a few questions, which he did, as follows:—What other final result was obtained by Messrs. Bryceson's new pallet or pneumatic obturator, as described in Figs. 1, 2, 3, of their specifications, which was not fully attained by Mr. Barker's arrangements and the ordinary pallet? True, a slight simplification was effected, but was not this advantage more than compensated for by the difficulty of access to the disc-valves and electro-magnets, which were all enclosed in air-chambers, where they could not be regulated under the pressure of the air, and where they could not be got at without first letting the wind out? Was it not a considerable advantage in Mr. Barker's construction that the two pneumatics, with their single disc-valve and electro-magnet were all placed externally, and could be easily regulated, or even detached from the sound-board, if necessary, in less than a minute? Was not the introduction of the exhausting bellows an additional expense? As it did not preclude the necessity for a high pressure bellows for certain stops, did not Mr. Bryceson's arrangement necessitate a peculiar construction of the sound-boards, which would require a complete reconstruction in applying electricity to any existing organ? With respect to Messrs. Bryceson's electrical drawstop-action, as shown in figures 4 and 5 of their specification, was there not an enormous consumption of electrical current (such as few batteries could supply) occasioned by the way in which the electro-magnets acted on the disc-valve of the pneumatic? For example, a given position of the drawstop-slide could not, he believed, be maintained without the constant action of the current on the corresponding electro-magnet; and did not this involve the simultaneous existence of as many currents as there were stops in the organ? Would not the expenditure of electric power be greater in this case than that for all the manuals united?—and was not Mr. Barker's plan preferable, which, by the aid of an escapement, only required the momentary action of the current? In the drawstop-action (shown in fig. 5 of specification) the introduction of the old "puppet" movement to a certain extent obviated the difficulty, on condition, however, of the stop not being too quickly drawn, as the action of the current must be maintained until the pneumatic became inflated or discharged;—but must not the current be constantly maintained in the electro-magnets of the indicators—at least for one position of the slider, either in or out? The puppet-movement, again, was not generally considered by organ-builders as very sure in its action. In the drawing figs. 4 and 5 of drawstop-actions there existed a kind of appendix attached to the principal pneumatic, near the hinge (of which no mention was made in the specification) which would seem intended to maintain the disc-valve, upon which the electro-magnets acted, in a fixed position, independently of the keeper, with a view to dispense with the continuous passage of the current; but, as shown in the drawing, this would paralyse the action of the keeper-valve, by preventing its being drawn down by the keeper when the magnet came into action.

Mr. Limpus said that as allusion had been made to an accident which had occurred at St. Michael's, on a recent occasion, it was only fair to Messrs. Bryceson for him to state that, on that very morning, the two men who were, or should have been blowing, had acknowledged that they were asleep on the occasion referred to.

---

* See Roret's "Encyclopedie," published in Paris, 1854.

Mr. Forster wished to add to his former remarks on the history of the matter, that the late Herr Schultze, the clever German organ-builder at Paulinzella, was the first to apply electricity to organs and pianofortes.

Mr. Gern would like to know what was the difficulty in connecting the key-board of an organ with the pipes, by mechanical means, at any distance. With regard to the exhaust, that was not at all a new thing; he knew an instance in a church near Toulouse where it was applied.

Mr. Hoyte said he was the organist of All Saints, Margaret-street, where the organ was worked on the pneumatic principle. Part of the organ had been divided and removed to a distance of 90 feet; but the touch was remarkably accurate, and not heavier than that of an ordinary grand pianoforte. This was not an electric organ.

Mr. Botly desired to add his testimony as an amateur to the opinion expressed in the paper, that the western gallery was the best place for an organ; some time ago, when churchwarden of St. Thomas', Salisbury, one of the finest parish churches in England, he had successfully opposed an attempt which was made to remove the organ from that position; and he believed that, generally speaking, no better position could be obtained, either considered acoustically or architecturally.

Mr. Bavin said that he had recently had an opportunity of trying the organ at St. Michael's, Cornhill, and would like to know how it was that when he held down eight or ten keys he only heard six or seven tones, and that the pedal note only came in about a second after the pedal had been depressed. The same delay in the speaking of the notes, but in a less degree, was noticeable in the manuals.

Mr. Bryceson, in replying to the observations and questions, said, with reference to Mr. Forster's first observation as to the length of the sound-board, that this would depend entirely on the arrangement of the pneumatic levers. It was quite possible to put them in two or three rows, when they would not require a very long sound-board. In foreign organs there was generally plenty of room, and therefore Mr. Barker had probably not paid so much attention to this part of the subject. As to Herr Schultze being the inventor of the electric organ, he had only to say that he had prepared the paper from the best information which he could obtain from Mr. Barker. It was totally impossible for him to say what suggestions or experiments had been made, but the question was, had Herr Schultze produced any tangible result? He had already referred to the keeping their organs in order, as to which there was no difficulty; but he might remark that fears of this kind were not to be wondered at, considering the great ignorance which prevailed in the public mind as to the nature and properties of electricity. With regard to Mr. Beer's first question, Mr. Barker's arrangement might be founded on an intermediate application of the pneumatic lever, and then the resistance of the pallet remained; and in cases where electricity was applied to existing organs this arrangement was followed in order to make use of the existing mechanism. Mr. Barker himself, however, alluded to the necessity, or desirability, of attacking the pallet directly by the electric current, and for that object their new arrangement was designed. Although the pallet was within the sound-board, it was got at in the same way, and quite as easily as the ordinary pallet; the fall-board being taken off, the pallet could be taken out or put in with the finger and thumb. Of course, the pallets being within the sound-board, would be less likely to be damaged than in the ordinary arrangement. As to the questions relating to the drawstop action, he must remark that Mr. Barker's organ at St. Augustine's had not an electric drawstop-action, and that gentleman's arrangements for this purpose were based simply on theory and imperfect experiments; when these arrangements came to be carried out in English organs they met with the difficulties to which he had alluded in the paper, and, as he had there stated, they had succeeded in overcoming them by an arrangement which he had purposely omitted explaining in detail. Mr. Barker proposed a positive and negative electro-magnet with two armatures, one catching into a notch in the other; but it was found in connection with the opera organ that with this plan, if the valve were regulated tight, the armature sometimes missed, whilst if it were made loose, there would be an escape of wind through the disc-valve, which, though not of much importance in a small organ, would be a serious matter in a large one, and occasion a heavy pressure. Mr. Barker also proposed two accessory power-bellows, arranged in a very curious manner, and his (Mr. Bryceson's) aim had been to simplify matters and cheapen production as far as possible. He also believed that the action of the double armature was more certain than that of the two single ones catching one into the other. He had told them honestly what he knew, and was very glad to hear the observations which had been made; but several of them were occasioned, as he had previously remarked, by his purposely abstaining from going into details as to their newly-invented electric drawstop-action. The sound-board did not require to be of an extraordinary length, as had been suggested, and his improved pallets could be made of every size from a ¼ of an inch upwards. The current of electricity was not always on in the new drawstop-action, and in fact there was no waste of material in connection with it, but he could not go into particulars much beyond that statement; and, in fact, the subject would require a whole evening to itself to explain fully. The defects Mr. Limpus had spoken of arose from the mechanism at St. Michael's not yet being complete, there being at present only a temporary console. In reply to Mr. Gern, he could only say that it was a question of position. If, as in the case of Mr. Hoyte's organ, the trackers ran in a direct line, although the distance was 90 feet, there was no difficulty, only the mechanism would often require regulating, but where the organ was so placed that the mechanism would have to be carried round corners in various directions, the difficulty would be almost insurmountable. In an electric organ, on the other hand, distance and position were not of the slightest consequence. Mr. Bavin complained that the pipes did not always speak; he could only say that as the organ was not yet finished, men were constantly at work upon it, which might account for this failing. He hoped all those who were interested in the matter would notice when the organ was opened, and he should be much pleased to afford them any further explanation.

The Chairman then proposed a vote of thanks to Mr Bryceson, which was carried unanimously.

The diagrams used by Mr. Bryceson to illustrate his paper will be reproduced as woodcuts, and issued with a future number of the *Journal*, on a separate sheet, which should be bound with the volume.

Proceedings of Institutions.

Birkbeck Institution, Southampton-buildings.—The prizes awarded at the last examination of the Society of Arts, and also other prizes in connection with this institution, were distributed by Mr. Reverdy Johnson, the American Minister, on Friday evening, the 18th instant. Having presented the prizes, Mr. Johnson said,—I highly appreciate the honour the trustees of this institution have done me by requesting me to preside on this occasion. For one as far advanced in life as I am, having seen so many vicissitudes among those who have not had means of education at their disposal, it is exceedingly pleasant to witness how you have availed yourselves of the opportunities which have been offered to you. Having been in my own country a witness of the results of many examinations, I can say that I have never seen any which gave me more delight than the present. It is peculiarly interesting to me to find that the competition is not confined to one sex. The lady—fairest of God's creation by a great deal—was not only designed to be a comfort to man, but was endowed with faculties amply sufficient to attain every variety of knowledge, in order that she might supply his intellectual wants, if he had any, as well as fulfil her more homely duties. I am delighted to see that among those to whom prizes have been awarded the highest honours have been taken by the fair sex. The men, indeed, might be uneducated if the women were, and the country would get on; but if the men are educated and the women are not, the country might get on, but what sort of a "get on" would it be? What kind of a home is that which a scientific or literary man has when he finds that his helpmate has no sympathy with his labours and pursuits? He might as well have married a savage. What can she do towards the relief of his anxious hours of toil? What assistance can she be to him when, poring over his books, he finds himself at a loss? But if, on the contrary, his wife were educated, how she would refine his home; what purity she would communicate to the atmosphere of his fireside; and what temptation would he then have to wander from the fairest, happiest place assigned him by the providence of God? I come here from a scene at which I was present an hour or two ago in a school of a very different description. There I saw some 600 boys and girls taken from the very poorest of the poor of the metropolis, in the charge of men who do all they can to save them from the crime into which they would certainly be led if education was not afforded them. All these boys are learning to read and write. Even the poor shoeblack, who wanders up and down your streets in the hope of finding some dirty boot and with it a penny, is being educated, and so beneficial has been that education that these boys have, by the pennies they have gained as the result of their apparently menial services, saved among themselves the enormous sum of £9,000. They have the good fortune to have presiding over their institution a nobleman by nature as well as by birth—one who has a grant of nobility from a higher source than kings or queens can command,—a nobility which is to be found in the heart. I refer to the Earl of Shaftesbury. He has devoted himself with untiring zeal to that institution, and it was delightful to me, as I sat beside him while he spoke a few words to those 600 children, to observe how happy he seemed. He felt that whatever good he might possibly do in the House of Lords as one of the legislators of this great realm, he was doing much more good by bringing up the children of the metropolis by thousands and hundreds of thousands to know their duty to men and to their God. A great man and a good man is ever a man of delicacy. I, therefore, forebore to speak what I thought of him before his face, because I knew that that delicacy would be wounded; but I will say here, without calling in question the acts of any others among the nobles of the land, that every Englishman must wish that all the peers of the realm were of the type of the Earl of Shaftesbury. The founder of this institution, as you all know, was Dr. Birkbeck, a medical man of great skill, and also accomplished in every department of science and literature. Having gained by his profession a handsome sum of money, he resolved to discontinue the amassing of wealth, and to see what he could do to educate the people of his country. How his memory has been honoured for that resolution. The mightiest hero who ever led armies to victory, and earned glory by wading through seas of blood, might envy the inscription which might and ought to be written on a monument to the memory of Dr. Birkbeck. But he was not alone in his undertaking; he had a coadjutor sufficiently powerful by title and position to do everything necessary to further the accomplishment of his purpose. It was he who said the pen was mightier than the sword, and that whatever Powers might be abroad threatening the freedom of England and of the world, a mightier power on freedom's side was gaining strength day by day, for the schoolmaster was abroad. Need I name Henry Brougham, literally at one time the tribune of the people, speaking in the House of Commons and in the House of Lords a bold, eloquent language which even made a would-be king tremble, and forced the peers to acknowledge his power, and act in obedience to his advice? It was his speech, among others, which induced that high body to sanction the first Reform Act; it was his speech, with the speech of Denman, that caused the Lords to tremble at the idea of convicting an injured Queen, and forced from them the words "Not proven." With such a founder and such an assistant what doubts could have been entertained of the success of this institution? If any such doubts have been entertained in the past, what we have witnessed to-night must make doubting impossible for the future. Conducted by the able men in whose hands the institution is now placed, it will continue to prosper until it has reached a height as great as human effort and ability can place it on. And now let me say a word to you who are pupils here. Your teachers have told you and have told us that you are deserving of all honour; they have borne testimony to your excellence, moral and intellectual. Never forget it; carry the remembrance of this night with you in after-life, and you will find that if at any moment you are disposed to stray from the path of absolute integrity, your steps will be arrested by the thought of how pained your teachers would be if they supposed you were on the point of giving way to temptation.—A vote of thanks to the Society of Arts for the benefits it has conferred upon institutions of the Birkbeck description, was carried on the motion of Mr. Locke, M.P., seconded by Mr. Gilpin, M.P., and was acknowledged by Lord Henry Lennox, M.P., chairman of the council of the Society. Thanks were presented to the examiners on the motion of Mr. Charley, M.P., seconded by Mr. Garland. Thanks were also presented to the gratuitous teachers, on the motion of Mr. Cole, C.B., who, however, objected to gratuitous services, and strongly urged the council to apply for assistance to the Science and Art Department, as, on the principle of payment by results, the institution was fairly entitled to a grant of upwards of £100 per annum. A similar compliment was paid the governing body of the institution. Responding to a vote of thanks for his services in the chair, Mr. Reverdy Johnson said,—I have come among the young this evening to see whether they are animated by the same feelings towards my country as characterize all those in England who are not young, with the exception of one or two or more. With regard to those one or two exceptions, I may say in a language which I find is understood by some of you here—*De minimis non curat lex.* To suppose that war is possible between the two countries is to suppose that those in whose hands the destinies of the two countries are placed are mad; and as I know that those in whose hands the destinies of my country are placed do not belong to that class, and as I know with equal certainty that the man in whose hands the destinies of your country were placed a week or two ago, and he in whose hands they are now placed, are anything but madmen, we have a sufficient guarantee that the friendship between us will never be disturbed. It is trite to refer to the similarity of our institutions, but it is a fact which should ever be borne in mind when we are talking of the possibility of hostilities between the two countries. Our institutions are almost identical; and one element in the case which should not be lost sight of is this—that our ancestors learned them from you, and have not forgotten to teach them to us. We have found that those institutions are soundest which rest on the public feeling of the people, and our experience has taught us that if, at any time, in either country a Government should go against that public opinion after it has been thoughtfully formed, the days of that Government are numbered. The best way of securing such a public opinion is that of establishing a liberal system of education. We are not guilty of the mistake of not paying our teachers; the teacher with us, to say nothing invidious, is paid a great deal better than some of your curates; and when we find a place destitute of education, we tax the people to make good the defect. Then, not only are our institutions identical, but we have the same language, and although we speak it better than you do, we understand each other, and by and by you will be able to speak the language as well as we do. With a common origin, glorying in the same renown, and proud of the same great men, we are resolved that we will at no time permit our free institutions to be taken from us.

Union of Lancashire and Cheshire Institutes.—*Bolton New Mechanics' Institution.*—The new building is in the Italian style of architecture, with slightly Gothic character in the detail, the exterior being of brick, with stone doorways, strings, and other dressings. In the basement are a number of rooms for the elementary classes, the heating chamber, store-room, and porter's residence. The reading-room, which is on the ground-floor, at the right of the entrance, is 43 feet by 23 feet 6 inches, and is boldly treated, the wall space being divided by pilasters, with enriched caps, while the ceiling is in panels, formed by the beams which support the floor above. On the ground-floor are also a library, 33 feet by 18 feet, the committee-room, secretary's room, and conversation room. Four entrances are provided on this floor. The male and female departments, except to the officers of the Institution, are kept thoroughly distinct. The principal staircase to the lecture-hall is of stone, finished with handsome iron balustrading and oak hand-rail. On the first-floor is the lecture-hall, 60 feet long by 33 feet wide. The walls of the room are divided into bays by panel pilasters, with enriched caps, and the ceiling by the transverse beams carrying the floor above. Near the platform is a lecturers' ante-room, with lavatories, &c. There is also on this floor a large class-room for female students, which is so arranged as to be available for a ladies' ante-room, with cloak-room adjoining. On the upper floor is the mechanical drawing-class room, which extends over the full area of the lecture-hall beneath, and has a large lantern light. The remainder of this storey is appropriated to female class-rooms, with lavatories, &c. The whole of the rooms are lofty, well lighted and ventilated, and heated by Messrs. W. and J. Cole with hot water, the pipes being so arranged that the different departments of the building may be warmed separately. The building has already cost £6,000, and it is estimated that £1,500 more will be required to complete it. To realise this sum the committee of the Institute determined to inaugurate the new building by a fine-art and industrial exhibition. A meeting of the principal friends of education in the town and neighbourhood was convened in June last, and the scheme submitted by the committee met with unanimous countenance and support. The opening ceremony was performed in the lecture-hall, on Monday the 7th December, by A. Trollope, Esq. The hall was densely crowded. Addresses were delivered by Mr. Trollope; Mr. Alderman R. Harwood, President of the Institution; Mr. Barlow, Mayor of Bolton; Col. Grey, M.P., and Mr. Hick, M.P., the borough Members; Mr. C. D. Darbyshire, &c. In the afternoon there was a luncheon at the Co-operative Hall, when the attendance was numerous.

MEYRICK COLLECTION OF ARMOUR AT SOUTH KENSINGTON.

The collection of armour and arms formed by the late Sir Samuel Meyrick has, with the consent of the present owner, Colonel Augustus Meyrick, been sent up to London, in order that the public may have the advantage of viewing it during the term of its loan to the South Kensington Museum. The gallery in which space has been provided for the exhibition of this interesting historical collection is one of those occupied for the past three seasons by the National Portrait Exhibitions, on the ground-floor. The public generally will perhaps remember this gallery better if it is described as the lower east refreshment room of the Exhibition of 1862. The collection will be open to the public on Saturday, the 26th December.

Containing, as it does, an immense number of arms of all periods and varieties, it may not be out of place, especially at the present holiday season, to glance cursorily round the collection, and, in as short a space as possible, to specify, according to the bays to each of which one period of the manufacture of armour has been assigned, the more important specimens which it is believed are worthy of particular notice. The arrangement of the collection has wisely been entrusted to Mr. J. R. Planché, and is strictly chronological. Although to the uninitiated the first bay of arms and armour may not appear so attractive as many others lower down, still there can be no question that the ancient British gilt bronze buckler, or as it is technically termed, "the gilt bronze covering of an ancient ysgwyd (an imitation of the Roman scutum) is archæologically the first specimen in the collection. As a specimen of *repoussé* ornamentation, the crispness of the work is well worthy of the critical examination of living artistic metal workers. Examples of this specimen of work are in the possession of the Royal Irish Academy in Dublin; unfortunately, except by dint of persuasion and importunity, the public are not able to inspect them at present. The two circular shields or targets in the same case as the buckler are remarkable for the excellent condition in which they are. The series of Etruscan and Roman helmets in the glass case is curious, but to the public generally will not prove so interesting as that of the tilting helmets. The most remarkable one, placed the second in the set arranged on the shelf at the back of the bay, belonged to Sir Richard Pembridge. Notice should be given to the small battle-axe placed at the lower side of the central group of maces, &c., on the wall. This battle-axe is said to be the earliest one extant. The handle consists of a barrel: about half-way up the handle is a small touch-hole. The date assigned to this arm is 1440, and it is described by Skelton as a "Battle-axe with gonne." The trophy of shields and saddles, &c., forms a capital centre to the bay. The saddle of carved bone is German fifteenth century work, and represents two lovers in the costume of the period. The legend surrounding the bas reliefs is as follows:—

Woman. Ich pin hie, ich ways nit wie,
Ich var von dawn, ich waus nit wan.
Nu wohle auf mit willen unvergessen.

Man. Ich var, ich har, ye lenger ich har
Me gresser nar
Dein ewigleich land ierigen varn.

Woman. Me den krg. ent.

Man. Ich frei mich all zeit dein.

The translation of the above is—

Woman. I am here I know not how,
I go hence I know not where,
Well a day! willingly that art never forgotten.

Man. I go, I stop, the longer I stop
The more mad I become;
Thine for ever the world o'er, your betrothed!

Woman. But if the war should end?

Man. I should rejoice to be always thine.

At the back of the trophy is a formidable looking weapon, called a "Demi holy-water sprinkler." The upper circular portion, bristling with dangerous looking points, conceals four barrels, which can be loaded and fired off when the spike at the top is removed. This implement was used in the time of Edward IV., and the present one is an excellent specimen, well preserved. Before entering the next division, note should be taken of the ship's swivel-gun, fished up off the coast of Boulogne.

A stand of bills, spetums (a blade with lateral projections, fixed to a long wooden handle), morning stars (balls studded with spikes and connected to the handle by a chain) and holy-water sprinklers, is the division between the first and second bays. In this latter bay, the chief object of attraction is a mounted figure, in a complete suit of armour, delicately fluted—temp. Henry VII. At the back of the bay, is the largest tilting helmet in the collection. An arrangement of bucklers, maces, engraved swords, one particularly deserving study, engraved by Albert Durer, representing the Conception and St. Barbara, on one side of the blade, and on the other St. George and St. Christopher, forms a well disposed background. To the front of the rack of halbards, glaives, &c., separating the times of Henry VII. and Henry VIII., is a gorgeous court suit of armour, puffed and ribbed, and damascened. The gold work, unfortunately, of the enriching ornaments is worn away considerably. This bay—the third one—contains several excellent examples of armour. Amongst the mounted figures is a rather quaint and evidently cumbersome black, German *cap-a-pie* suit, on the breast-plate of which, in engraved and gilt-work, is a representation of the Virgin and child. The horse armour of this figure is very good and complete. The horse's bit is a work of some artistic merit—the enamelled bosses are interesting. Two of the simplest suits of armour, unornamented almost, are in this bay; they are fluted, and of bright steel. On the champfront of the horse armour belonging to the second one of these two figures, is a curious inscription:—

NIXVN
WA
YERSVOC
HI

The work is from Nuremberg. Of the standing figures, almost the best one is a suit for a demi-lancer, with a bright floriated steel design in relief, of Genoese work; temp. Henry VIII. Next in interest is a knight of St. George, the armour being painted black, and the centre of the breast-plate bearing a conspicuous red cross. This third bay contains early examples of engraved armour, of which the best specimen probably is the complete suit on a standing figure, of work of about 1570.

Ranged along the shelf, at the foot of the trophies of arms fixed on the wall, are a number of fine breast-plates. The first one without any point in it, and the last of the set, with a strongly-defined point, with the intervening ones, each one having a varied position for the point, show how the pointed form of breast-plate originated. Some very fine double-headed swords, surrounded by glaives, maces, halbards, &c., are conspicuous objects. Before leaving this bay, visitors should inspect an interesting jester's cap in iron.

(*To be continued.*)

BUDGET OF THE CITY OF PARIS.

The prefect of the department of the Seine has just published his annual budget for the city of Paris, and the adjoining arrondissements of St. Denis and Sceaux, from which we extract the following items:—

It appears that the effect of demolition and reconstruction during the last twelve months has been to increase the number of houses by 1,921, and that of apartments by 14,460 in the whole of the twenty arrondissements within the fortifications. The increase is, however, confined principally to the outskirts, or what is now the outer circle of the city. In the Bourse quarter, the number of houses has been diminished by 33, and the number of apartments by 916; in the two adjoining quarters of the Pantheon and the Luxembourg, the reduction amounts to 73 houses and 1,592 apartments.

The direct taxes, that is to say, land-tax, house, window, and door taxes, and trade licences, amount for the whole department of the Seine to 43½ millions of francs, or £1,732,295, or about one pound per head for the entire population. Of the 43 millions, upwards of 40 are derived from Paris itself. Only a portion of these taxes go to the city, the rest, about half, belong to the State.

The total of the expenses of Paris, ordinary and extraordinary, but exclusive of the special budget, amounts, it appears, to rather more than 24½ millions of francs, or £987,109.

The budget for 1869 is very nearly the same as was originally that of 1868, since increased to the extent of twenty per cent. by supplements.

The following are amongst the most important facts presented by the account of operations during the current year:—The number of primary schools has been increased by thirty-three, of which eleven are public, the total number being at present 1,892. In addition to these there are 254 adult schools, or rather classes, and 200 asylums. The number of pupils at the primary schools is not given, but the whole number of persons attending the various schools and asylums is given as 255,145, or rather more than one-seventh of the entire population.

The document concludes with a congratulatory paragraph on the great change which an abundant harvest has made in the price of bread, as compared with last year, thus relieving the city from the onus of regulating the bakers' prices.

Fine Arts.

Art Decoration of Theatres.—An unusually artistic character has been given to the decorations of the new Gaiety Theatre, only just opened, the most noticeable feature being the frieze over the proscenium, designed and painted by Mr. H. S. Marks,—30 feet long by 4 feet 6 in. deep. It represents a king and queen of mediæval times, with surrounding courtiers, watching a masque which is being performed before them. On either side this frieze, over the proscenium boxes, are lunettes in the arches—the one to the left represents lyric, and the other epic poetry—designed by the same artist. These pictures, which are really fine works of art, have been painted by Mr. Marks with a view to their forming a part of, and, in a measure, being subservient to the general scheme of decoration. The coloured decoration of the auditorium and the lobbies was executed by Mr. George Gordon, and partakes somewhat of the early Romanesque character. The same artist has also painted the Act Drop, which, unlike that at most theatres, is intended not as a scene or a picture, but as a part of the decoration of the theatre. It may be mentioned that the lessee of this theatre is Mr. John Hollingshead, well known as an author, who has been a contributor to the Society's *Journal*, and who wrote the introduction to the Illustrated Catalogue of the International Exhibition of 1862.

Reading-room at the National Gallery.—The acquisition of Sir Charles Eastlake's art library, recently purchased by the National Gallery, and the removal of the library of the Royal Academy to Burlington-house, have induced the trustees to form a collection embracing every attainable work relating to the fine arts, and to establish a library of reference and reading-room for the use of students, and accessible for the public under certain regulations.

Monument to the Memory of Rossini.—Not long since Mdlle. Esther Le Clerc, in the name of her late brother, Achille Le Clerc, presented a sum of money to the Academy of the Beaux Arts of Paris to found a prize of a thousand francs for a work of art; the other day, on the occasion of the annual meeting of the academy, it was announced that the first subject for the Le Clerc prize would be a monument consecrated to the memory of Rossini. The competition is divided into two stages:—First, a sketch, which is to be sent in on or before the 28th of the present month; and, secondly, a model, to be sent in by each of the successful competitors in the first trial. The final competition is fixed for the 30th of March, 1869.

International Exhibition at Munich.—The Minister of Public Instruction has been instructed, by the King of Bavaria, to make the necessary arrangements for the holding of a grand exhibition of national art at Munich next year. It is expected that the collection of works of art will be a very large one. The date for the opening of the exhibition is not yet announced, nor are the conditions, which will doubtless be similar to those of other exhibitions of the like character.

Manufactures.

Exhibition of Industrial Art, Paris.—The Union Centrale des Beaux Arts, which has several times been mentioned in the columns of the *Journal*, and whose proposed college of applied art is, it is said, only deferred, not abandoned, has determined to hold another extensive exhibition of applied art, which is announced to open in the Palais de l'Industrie, on the 10th of August, 1869, and to be closed on or after the 10th of November. The programme contains six groups, designated as follows:—1. All kinds of works of art executed with a view to industrial reproduction. 2. Productions of art manufacture. 3. Models and productions of artists and manufacturers taking part in the ordinary competitions of the society. 4. The works of the pupils of all the schools of design of Paris, and the departments, who are invited to take part in the exhibition. 5. Collections of objects of all kinds of decorative art of past times adapted to the instruction of the artists and art-workmen of the present day. 6. Original drawings and models for industrial purposes and decoration left by the old masters in applied art; and a gallery of portraits of past times exhibited with a view to the history of costumes. The exhibition will, therefore, like its predecessors, be both retrospective and contemporary, and there is little doubt that it will even surpass in importance the former very brilliant collection previously brought together in the same building by the same society.

Commerce.

Cultivation of the Caucasus.—A company, which has recently obtained for sixty-five years a grant of a large tract of land in the Caucasus and on the Persian frontier, is about to raise a capital of twelve and a-half millions of roubles in shares. This capital is to be employed in the following manner:—Eight and a-half millions in works of irrigation necessary for preparing the lands for the production of wheat and other cereals, madder and cotton; three millions in the construction of factories and works much required in the Caucasus; and one million in making loans to proprietors of land, and in the establishment of a bank which it is proposed to found at Tiflis.

Wine Adulterations.—The following is from the *Produce Markets Review*:—"History relates that among the many rages of the fashionable world, in the early part of this century, there figured an incomparable salad-dresser, who used to spend the whole day in driving round in his chariot from one customer to another, mixing salads, for each of which he demanded and obtained the modest fee of two guineas. In our modern days the successful but harmless salad-dresser has, according to a weekly Paris journal, *L'Eclipse*, been succeeded by a much more objectionable class, who go round amongst the few dishonest growers and merchants, wine-doctoring, and whose charges our contemporary gives in an amusing article, which, translated, runs as follows:—'The public is aware that wines are adulterated, but it is ignorant, we think, to what an extent this is done, nor is it aware how curiously the wine industry is organised, and how each kind may be imitated by means of ingredients utterly innocent of any trace of the grape. We think, however, that nothing similar to the perfectly authentic document which we copy here, and which is printed and circulated in the trade, has yet been published.

	Fr.	c.
For giving new wines the colour of old (per 230 litres)	1	50
For giving wines the taste and perfume of old Burgundy (per 230 litres)	3	0
For colouring in rose-colour and in red (per 230 litres)	4	50
For imitating with *vin-ordinaire*, Madeira, Marsala, Muscatel, Malaga, Alicante, Vermouth, Port, Lacryma Christi, Greenache, Sherry, Tokay (per 20 litres)	5	0
For imitating the taste of Beaune (per 230 litres)	3	0
For imitating Chablis (per 250 litres)	2	50
For giving white wines the taste of champagne (per 230 litres)	5	0
For giving corn-brandy the taste of Cognac (per 100 litres)	6	0
For imitating the colour of Curaçao and Bitters (per 100 litres)	2	0
For imitating Rum, Kirsch, and Absinthe with alcohol (per 50 litres)	6	0
For imparting to beetroot-brandy the taste of *armagnacs* (per hectolitre)	4	0

The above will show how easy and profitable is the trade in wines. We dedicate these few facts at once to hard-drinkers, and to those who, careful for their health and for their purse, desire wine or some natural liquid in return for their money.' "

Silk Trade between Italy and France.—The exports of silk from Italy to France, from 30th September, 1867, to 30th September, 1868, show a considerable increase on those of the previous year, and were as follows:—

	Kils.		Value Frs.
Grains (eggs)	4,900	....	623,400
Cocoons	119,900	....	2,975,350
Raw silk	219,000	....	14,679,300
Worked silk	868,000	....	85,100,200
Floss silk	1,050,400	....	17,083,450
Total value of exports			120,461,700

The imports from France to Italy during the same period have greatly diminished, being about two-thirds of those of previous years.

Imports to Italy from France.

	From Sept. 30, 1867, to Sept. 30, 1868, Francs.		From Sept. 30, 1866, to Sept. 30, 1867, Francs.
Printed foulards	1,458,568	..	1,542,197
Plain stuffs	9,161,724	..	14,780,872
Worked stuffs	724,662	..	1,084,777
Mixed stuffs	1,786,457	..	2,601,546
Fringes and trimmings with gold and silver	351,935	..	671,150
Do. do. all silk	373,355	..	289,710
Do. do. silk	574,070	..	1,016,514
Ribbons	1,204,070	..	1,900,377
Tulle	870,625	..	941,125
	16,505,466	..	24,828,268

Colonies.

Land in Victoria.—In the colony of Victoria there were, in January last, upwards of 40,000,000 acres of land not yet alienated from the Crown, nearly half of which will be immediately available for agricultural settlement, on the principle of free selection, in areas of 20 to 100 acres, on very easy terms; while the other moiety is likely to be thrown open on similar conditions in the year 1870. This land affords accommodation for nearly half a million immigrants, who would enjoy the right of selecting a farm over at least one half of the colony. For the beneficial occupation of 100 acres the immigrant would have to pay £10 per annum for three years; and then, if he had meanwhile proved his *bona fides* as a settler by cultivation or other permanent improvements, he would be entitled to receive the fee simple of his land on the payment of something less than £1 per acre.

Acclimatisation in Victoria.—The Angora goats introduced into the colony have thriven and increased. The society has a flock of 150 ewes, and 70 pure-bred rams are now distributed over the colony to improve the common breed of goats. The fine woolly hair will, ere long, be an important article of export and manufacture. The common honey bee was introduced only a few years ago, and large quantities of honey and wax are now produced in various districts. The silkworm has also been introduced, and from the recent extensive plantations of the mulberry, silk will soon be numbered among the staple products. The camel is also established in the colony, and its perfect adaptability to the Australian climate is now proved. Not wanted within the bounds of Victoria, it will be invaluable as a means of transport over the sandy and arid districts of the interior.

The Northern Territory of Australia.—The efforts to form a settlement at Burke Town, in the northern territory, have been very successful. The livestock has increased during the first three years to 1,500 horses, 50,000 head of cattle, and 200,000 sheep; whilst the trade of the place showed, for one year—exports to other colonies, £8,118; and imports from other places, £15,582, which was irrespective of shipments to and from the ports of Queensland.

Notes.

The Brindisi Route.—The service between Brindisi and Alexandria, and *vice versa*, is now carried on with great regularity by the Adriatic and Oriental Company's steamers, one of which, the *Principe Tomaso*, in her last voyage from Alexandria to Brindisi, made the passage in 74½ hours.

International Exhibition at Hamburg.—In the beginning of September, 1869, there will be an International Exhibition at Hamburg, for the purpose of giving all those who are interested in the science of horticulture, and in the various machinery connected with it, an opportunity of becoming acquainted with the immense progress and wonderful development in gardening; they will also be able to exhibit their own inventions and improvements, and the result of their labour. The exhibition will be divided into three principal classes:—1st, cultivation; 2nd, architecture; 3rd, horticulture and its productions. These three great classes will be divided into special classes, in each of which prizes will be awarded.

Gas Lighting at Bari.—Bari, one of the most important towns of Southern Italy, was lighted with gas for the first time on the 19th September. The number of public lamps was 650.

Steam Ship for the Sultan.—A fine steamer, of 1,000 tons burden and 300 horse-power, was launched on the 30th November, at Trieste, from the ship-building yard of S. Marco. She was named the *Wassitai Tigiard*, and is the property of the Sultan of Turkey.

The Mont Cenis Tunnel.—During the second half of the past month (November), the progress made at the Mont Cenis tunnel was 62·10 metres, of which 32·40 metres were driven at the Italian side, and 29·70 metres on the French side. The position of these works up to the 30th November was as follows:—

Length driven at Modane..........	3·756·60
Length driven at Bardonnèche	5·319·40
Total length of tunnel driven	9·076·00
Total length remaing to be driven..	3·144·00
Total length of tunnel	12·220·

Correspondence.

Italian Mushrooms.—Sir,—Having passed many years of my life in Italy, I am able to corroborate Mr. Story's account[*] of the variety of fungi eaten and relished by the natives, the only one they generally refuse being the common English mushroom, which they call the "pratolino," because it usually grows in meadows. Their objection is that it is dangerous, from its similarity to the common toadstool, none of which they ever touch. Certainly the "ovolo" as described by that gentleman is the prince of mushrooms, and is so named in Tuscany because it is always eaten while still undeveloped, or in the state of button, and is often as large as a goose egg. When quartered for cooking, it exhibits those beautiful deep orange and yellow colours, though snow-white outside. A very similar mushroom—in appearance, at least—grows plentifully in some of our fir plantations; but I have never attempted to eat them in this country. When in Italy I have partaken of all the various kinds usually eaten, including many species of tender boleti, without feeling the slightest inconvenience. I should except, however, a boletus they call "*Spianta-Famiglie*," which is sometimes poisonous, though it is occasionally eaten by the natives notwithstanding its dreadful name. On one occasion I happened to have the top of a large tree reversed on my premises as a chopping block, the stumps of the three principal branches forming the legs. I was surprised by finding several large boleti growing in the fork, of course, head downwards; and wishing to know if they were edible, I made inquiries, and was told that as the tree was a white mulberry they were safe. I had them cooked, and they turned out very good, and I had a second and third crop before the wood got too dry. The only time I ever felt any inconvenience was from eating what we called morells, in Australia. For about an hour after the meal myself and my companion were convulsed with irrepressible laughter without any apparent cause, but no headache or other bad symptoms followed.—I am, &c., Henry W. Reveley.

Reading.

Artificial Refrigeration.—Sir,—In the paper read by Dr. Paul, on Artificial Freezing, he stated that "The merit of having put to the test of practical trial the idea of applying ice-making machinery to direct refrigeration, is due to Mr. King, the engineer of Messrs. Truman and Hanbury's brewery; and it is to his enterprise that those interested in the subject of artificial refrigeration are indebted for the working out of this problem." I was present at the meeting, but did not catch the meaning of Dr. Paul's words, which I heard indistinctly. Had I understood them as reported in your *Journal*, I should have challenged their accuracy at the time, as I have applied a powerful ice-making machine to direct refrigeration for the past three years, and in 1867, took out a patent for such application, which patent, according to Dr. Paul, must be infringed by Mr. King, who came down to Stratford to see my apparatus in September, 1867.—I am, &c., Charles E. Flower.

---

[*] See last *Journal*, p. 78.

Stratford-on-Avon, Dec. 22nd, 1868.

MEETINGS FOR THE ENSUING WEEK.

Tues ...Royal Inst., 3. Prof. Odling, "On Carbon." (Juvenile Lectures.)
Thur ...Royal Inst., 3. Prof. Odling, "On Carbon." (Juvenile Lectures.)
Sat......Royal Inst., 3. Prof. Odling, "On Carbon." (Juvenile Lectures.)

Patents.

◆

From Commissioners of Patents' Journal, December 18.

Grants of Provisional Protection.

Animal charcoal, apparatus for burning—3750—J. Bolton.
Bits and bridles—3754—W. Griffiths.
Boilers—3684—H. Kinsey.
Bones, &c., treating—3761—W. S. Jackson.
Bottles, &c., cleaning—3656—S. A. Daniell.
Boxes for transmitting patterns, &c., through the post—3502—W. P. Nash.
Brick-making machinery—3672—P. Hooker.
Bricks, &c., manufacturing—3746—S. S. Anderson.
Bridges, &c , roadways of—3744—G. P. White.
Buildings, constructing, &c.—3680—J. H. Banks.
Capsules for bottles, &c.—3653—W. Betts.
Carbonate of lime, treating—3368—J. H. Johnson.
Carding engines—3658—J. H. Johnson.
Cartridges—3709—J. Abraham.
Cataract lenses, &c.—3678—W. Pugh and J. Field.
Chairs—3674—E. W. P. Taunton.
Cigars and cheroots—3753—A. G. Goodes.
Coke, manufacturing—3718—A. Homfray.
Cotton, &c., opening and cleaning—3648—W. E. Newton.
Cotton, &c., piecing cardings of—3665—T. Warburton, jun.
Crucibles, &c., manufacturing—3739—G. Cooper and J. Cotterill.
Cultivators - 3735—T. Speir.
Driving bands—3543—I. B. Harris.
Electric telegraph cables—3661—C. S. Rostaing.
Envelopes, manufacturing—3666—E. Hely.
Fabrics, &c., bleaching, &c.—3712—D. H. Paterson.
Fences, &c.—3725—T. Kennan.
Fire-arms, breech-loading—3734—R. B. Roden.
Fire-arms, breech-loading--3769—H. Carter and G. H. Edwards.
Fur and hair, dyeing—3700—E. Francillon.
Furnaces—3681—J. Littler and J. H. Banks.
Furnaces, economising the consumption of fuel in—3737—T. Lancaster.
Furnaces, supplying with fuel, &c.—3701—J. A. Fawcett.
Gas burners—3273—W. E. Gedge.
Gig mills—3706—E. K. Dutton.
Girders for bridges, &c.—3668—H. N. Maynard.
Grain, &c., grinding—3755—J. Norman.
Gullies, &c.—3697—F. Beech.
Harrows, &c.—3705—H. Denton.
Horse shoes, appliances to be adapted to—3768—T. Holder & G. Dover.
Horse shoes, &c.—3721—E. Simons.
Horses, &c., clipping or shearing—3664—J. Tidmarsh.
Houses, &c., constructing—3772—F. Walton.
Houses, &c., roofing—3763 - C. E. Brooman.
Iron, &c., manufacturing—3330—A. Munro and W. B. Adamson.
Kilns—3710—J. Holmes.
Kilns for calcining limestone—3699—J. R. Swann.
Kilns for calcining limestone, &c —3740—C. P. Cotton & J. L. Lyster.
Knitting machines—3686—W. R. Lake.
Knives, &c., sharpening—3613—E. Stevens.
Lace fabrics, &c., cutting off the superfluous threads from devices made on—3743—J. Ball, jun.
Locks for bags, &c.—3638 L. Pfeiffer.
Locomotives—3370—J. Samuel.
Looms--3729—H. A. Bonneville.
Lubricating apparatus—3685—W. Simpson and J. Hutton.
Metal, &c., machines for cutting strips of—3748—F. Meadows.
Metals, shaping—3446—B. P. Walker.
Mines, ventilating—3767-- R. Waygood.
Motive-power, obtaining—3719—J. Ridley.
Oil cans, &c.—3692—J. G. Rollins.
Ordnance. breech-loading—3720—A Krupp.
Ores, &c., crushing—3704—R. Girdwood.
Organs—3640—T. Hill.
Paraffine, treating and purifying—3698—A. C. Sterry, F. Lambe, and J. Fordred.
Paving blocks or slabs of wood—3673—A. M. Clark.
Peat, &c., drying—3693—W. G. Ainslie.
Perspective drawings, instrument for facilitating the execution of—3629—W. E. Gedge.
Photographic apparatus, &c.—3722—W. R. Lake.
Photographic prints, washing, &c.—3695—H. L. D. Marsden.
Ploughs—3679—W. E. Gedge.
Presses for compressing metal, &c.—3551—E. T. Hughes.
Printers' formes, &c., locking—3675—D. Dorrity.
Printing in colours, &c., machinery for—3751—J. Parkins.
Railway breaks—3635—W. Naylor.
Railway carriage wheels, &c.—3702—B. Hunt.
Railway signals 3667—J. Alexander and J. Hill.
Railway signals—3745—W. Baines.
Railway trains, communication in—3636—G. S. Brown & E. Turner.
Railway trains, communication in—3733—O. Reynolds.
Railways, preventing collisions on—3738—F. W. and G. Moss.
Reaping and mowing machines—3683—R. Hornsby & J. E. Phillips.
Reaping machines—3770—P. Kotzo.
Reflectors—3671 T. B. Hubbell.
Roots, cutting edible—3687—W. R. Lake.
Rotary propellers, pumps, &c.—3694—M. P. W. Boulton & J. Imray.
Rudder pins, &c., preservation from corrosion of—3644—N. and R. G. West.
Salt-stones, manufacturing—3281—W. E. Gedge.
Sawing machinery—3703—D. Thomson.
Sewage, &c., treating—3714—A. M. Clark.
Sewing machines—3436—P. J. Livsey.
Sewing machines—3590—W. E. Gedge.
Sewing machines—3757—W. G. Manwaring.
Ships—3660—J. Grindrod.
Ships in dock, adjustable blocks for supporting the keel and bilge of—3747—J. T. Parlour.
Shuttles—3756—W. H. Platt.
Sketching and drawing instruments—3682—C. H. Chadburn.
Spinning and twisting frames - 3766—J. Pickles, E. Ramsbottom, S. Haggas, S. Foulds, J. Shackleton, and W. Berry.
Spinning machines, &c.—3579—R. Lakin and W. H. Rhodes.
Stays, &c., fastenings for—3670 S. Pallant.
Steam boilers, setting—3762—I. Smith and J. F. N. B. Simons.
Steam cultivators—3711—B. Fowler, D. Greig, and R. Burton.
Steam engines—3708—A. Masson.
Table expanders, screw boxes of—3732—J. Fitter.
Thimbles—3690—R. Charles.
Tiles, material for making—3642—A. M. Clark.
Type composing and distributing machinery—3728—A. Mackie.
Umbrellas, &c.—3741—W. H. Pottle.
Velvets, &c., weaving—3669—S. C. Lister.
Washing machines—3540—C. Smith and J. Macfarlane.
Watches—3730—W. J. Thicthener.
Weavings, manufacture of—3742—J. Kirk and J. Kirk, jun.
Wood, ivory, &c., imitations of—3651—J. H. Johnson.
Yarns, dyeing—3689—S. Hirsch.

Inventions with Complete Specifications Filed.

Measuring distances, &c.—3759—H. A. Bonneville.
Motive-power apparatus—3804—H. A. Bonneville.

Patents Sealed.

1983. E. R. Kaulbach.
2000. C. H. Murray.
2006. R. and W. K. Austin.
2008. E. T. Hughes.
2009. E. T. Hughes.
2015. G. Taylor.
2018. C. M. H. Downing.
2024. P. and B. Brown.
2025. C. T. Burgess.
2073. H. Large.
2079. S. Hannah.
2202. J. N. Willis, jun., and S. Judd, jun.
2317. W. S. Harrison.
2610. B. Walker & J. F. A. Pflaum.
2633. H. Ground.
2908. S. Fox.
3087. J. Dewar.

From Commissioners of Patents' Journal, December 22.

Patents Sealed.

2021. C. Johnson.
2034. J. Mitchell.
2035. S. Owens and T. Patterson.
2043. J. Briggs.
2044. J. Jack.
2047. J. G. Garrard.
2053. T. Dodd.
2054. M. Burke.
2055. T. Winder.
2056. R. Clough.
2059. A. Thomson.
2061. L. Thomas.
2063. T. C. Blanchflower.
2071. G. McCulloch.
2078. W. R. Lake.
2081. W. Baxter, D. Waring, and J. S. Wooller.
2082. R. Shaw and J. Clayton.
2084. A. V. Newton.
2088. W. R. Lake.
2098. G. Alder.
2101. W. Brookes.
2102. W. Brookes.
2103. W. Brookes.
2117. E. Pavy.
2119. A. M. Clark.
2120. A. M. Clark.
2131. M. Henry.
2140. A. M. Clark.
2194. T. Travis, W. H. Prince, and J. Tomlinson.
2274. E. Beanes.
2375. E. Herring.
2716. W. C. Green.
2838. J. Edmondson.
2869. J. H. Johnson.
2877. H. Vansittart.
2970. J. Gregory.

Patents on which the Stamp Duty of £50 has been paid.

3267. H. C. Ensell.
3247. G. Warriner.
3269. R. A. Brooman.
3265. C. Liddell & R. S. Newall.
3290. J. Martin.
3319. G. T. Bousfield.
3300. H. A. Bonneville.
3306. G. Hawksley.
17. H. Hirsch.

Patents on which the Stamp Duty of £100 has been Paid.

3197. J. Redfern.
3177. J. M. H. A. Taurines.
3183. E. Stott.